Appendix D

Part 5

the "dioxin-like" PCB congeners, using a reference dose of 1 [pictogram per kilogram – day] pg/kg-day, based on the value it states was proposed in EPA's draft dioxin reassessment. It should be noted that the EPA has never published a reference dose for dioxin and the draft Dioxin Reassessment does not recommend or propose a reference dose for dioxin or dioxin-like compounds. Therefore, the HHRA erroneously reports the existence of a reference dose that has neither been proposed by EPA nor has its scientific validity been established.

Response: EPA acknowledges some minor errors regarding the calculation of species-specific EPCs. It should be noted that reach-specific fillet EPCs calculated by EPA for sunfish are the same as those calculated by CBS. Also, the whole fish EPCs calculated by EPA are higher than, but similar to those calculated by CBS; the EPA whole fish EPCs are about 11 percent higher than those calculated by CBS. This difference in species-specific concentration will have little impact on exposures, risks, and hazards calculated based on these EPCs.

EPA agrees that the assumption that 50 percent of an angler's fish tissue intake can be attributed to sucker is overly conservative. Therefore, EPA has recalculated the reach-specific combined EPCs based on weighting factors that reflect the relative availability of each species in each reach, as reported in the HHRA. The combined EPCs calculated by EPA differ slightly from those calculated by CBS as discussed in the table notes. The EPA combined EPCs are 2 percent lower than (BD-2) and the same as (BD-3) those calculated by CBS.

	Concentration in Fish Tissue (μg/kg)			
	BD-2		**BD-3**	
Sample Type	**Sunfish**	**Sucker**	**Sunfish**	**Sucker**
Fillet	580	--	150	--
Fillet	580	--	130	--
Fillet	1400	--	130	--
Fillet	150	--	550	--
Whole (adj.)[a]	850	1350	150	550
Whole (adj.)[a]	400	2950	132.5	500
Whole (adj.)[a]	225	7000	135	650
Whole (adj.)[a]	--	2150[b]	--	--
Whole (adj.)[a]	400	1300	275	525
Whole (adj.)[a]	240	2100	215	550
Whole (adj.)[a]	550	3050[c]	167.5	700
Whole (adj.)[a]	145.25	1135	155.25	317.5
Whole (adj.)[a]	145.25	1135	155.25	317.5
Whole (adj.)[a]	145.25	1135	155.25	317.5
Whole (adj.)[a]	--	--	--	382.5
Average	447	2331	192	481
Weighted Average	455		201	

[a] Whole (adj.) concentrations were derived by multiplying the whole fish concentrations provided in Tables B-2 and B-3 of the HHRA by 25 percent for sunfish and 50 percent for sucker as discussed in Section 3.3.1 of the HHRA.
[b] This result was missing from the table prepared by CBS.
[c] This result was incorrectly reported as 6,050 by CBS.

EPA is aware that there is uncertainty associated with use of dioxin toxicity equivalents (TEQ) to evaluate PCB congeners. However, as stated in the HHRA, EPA recognizes that the use of the TEQ methodology as an official policy is still under internal review and that dioxin toxicity is being reviewed by the NAS. Nonetheless, use of the TEQ methodology "has a sound science basis and is widely applied in peer reviewed published literature" (EPA 2004d). Much of the current debate centers around the compound-specific toxicity equivalency factors (TEF) that should be applied and the uncertainty associated with these TEFs, rather than application of the TEQ methodology in general (EPA 2004c). EPA recognizes that a moderate to large amount of uncertainty is associated with use of the TEQ methodology. The presence of this uncertainty does not warrant dropping the TEQ methodology entirely (EPA 2004c).

With regard to the dioxin RfD of 1 pg/kg-day used in the HHRA to evaluate hazards associated with potential exposure to dioxin-like PCBs, EPA strongly disagrees with CBS's assertion that EPA has never published a reference dose for dioxin and that the scientific validity of the reference dose used in the HHRA has never been established.

EPA proposed an allowable daily intake (ADI) of 1E-06 μg/kg-day (equivalent to 1 pg/kg-day) as part of the Ambient Water Quality Criteria (AWQC) for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (EPA 1984). The ADI is equivalent to an RfD. In addition, the Agency for Toxic Substances and Disease Registry (ATSDR) derived an oral minimum risk level (MRL) of 1 pg/kg-day in the "Toxicological Profile for Chlorinated Dibenzo-p-Dioxins" (ATSDR 1998). Therefore, the scientific validity of the 1 pg/kg-day value has undergone significant peer review. Finally, it is irrelevant that EPA's Dioxin Reassessment (EPA 2003) does not recommend or propose a RfD for dioxins or dioxin-like compounds. It is EPA policy to use previous toxicological values and policies until toxicity factors (including RfDs) are finalized.

Comment 230: EPA has substantially reduced its fish consumption rates from the previous version of the risk assessment in which the fish consumption rates could not be supported by either the level of angling activity at the site or the productivity of the creek in the specified reaches. It was appropriate for EPA to consider the productivity and sustainable harvest from the three reaches of Stout's Creek in revision its fish consumption rates. However, the analysis conducted by EPA indicates that even the fish consumption rates of 1 and 3 g/day that have been used in the revised HHRA are not supportable given the limited productivity of the stream and the size of the fish there.

Based on EPA's calculations, the number of "harvestable" fish in BD-1, BD-2, and BD-3 can support one, two, and one angler at the reach-specific fish tissue ingestion rates without impacting the sustainability of the fishery. As a result, the HHRA is essentially predicting potential risks for a single angler [two anglers in BD-2] who might use the fishery. This is not consistent with typical risk assessment approaches.

As discussed by CBS (2005), these areas of Stout's Creek are not desirable fisheries. As a result, it is reasonable to assume that the size of the angler population is very limited, if it exists at all. However, if, as EPA asserts, Stout's Creek is used as a fishery, it is reasonable to assume that more than one individual would use it. Thus the fish ingestion rates are not reasonable as they will not allow the fishery to be sustained. If, for example, one assumes that a total of five individuals consume fish from each reach of the creek, then the total available fish mass needs to be divided among those individuals, as shown below.

Reach	Total Harvestable Fish (fish/year)	Sustainable/ Harvestable Fish (fish/year)a	Edible mass per harvestabl e fish (g/fish)	Total mass of edible harvestabl e fish (g/year)	Mass per person (g/year)	Ingestion rate (g/day)
BD-1	399	39.9	9.9	395	79	0.22
BD-2	953	95.3	22.8	2173	435	1.2
BD-3	1125	112.5	9.8	1103	221	0.60

a Based on EPA's assumption that 10 percent of available fish can be harvested without impacting sustainability of the fishery, as discussed on page A-8 of the HHRA.
b Assuming that a maximum of five individuals consume fish from each reach of Stout's Creek, this is derived by dividing the total mass of harvestable fish by 5.
c Derived by dividing the total mass per person (g/year) by 365 days/year.

This indicates that even if only five individuals consume fish from each reach of Stout's Creek as a fishery, a fish ingestion rate of approximately 1 g/day can be supported at BD-2 but only substantially lower fish ingestion rates of 0.22 g/day for BD-1 and 0.60 g/day for BD-3 can be supported by the available productivity information provided by EPA.

Alternatively, if EPA continues to use the consumption rates of 1 g/day for BD-1, and 3 g/day for BD-2 and BD-3, it is important for the HHRA to clearly point out, in its uncertainty analysis and risk summary, that the predicted risks presented could only occur for one individual in reaches B-1 and BD-3, and two individuals in BD-2. This information will allow risk managers who review the risk assessment to make informed decisions, taking into consideration the size of the population that is potentially at risk.

It should also be noted that it is probable that the "harvestable" mass of fish has been overestimated, making it likely that consumption would be even less than estimated above. This is because EPA has used all fish that are 3 inches or greater in length in estimating the total number of available fish for consumption. EPA has justified this by asserting that fish smaller than 4 inches in length, while difficult to fillet, are often pan-fried and subsequently consumed. However, such small fish are seldom consumed by anglers. As acknowledged by EPA, it is extremely difficult to capture small fish using a hook and line because the hook and bait used would be too large to fit in the mouth of such small fish. While someone could conceivably use a net to obtain these smaller fish, it is highly unlikely that someone would bother to do so, given that these fish are not targeted species for fish consumers, as also acknowledged by EPA. In addition, while someone could pan fry such tine fish, it would be extremely difficult to remove the small amount of flesh available after cooking without also obtaining skin and/or viscera. All of these problems make it implausible that 3 to 4 inch fish are regularly consumed.

Response: The HHRA does not describe Stout's Creek as a fishery, implying that sufficient fish are present to be regularly caught and ingested by a large number of people. Instead, the HHRA establishes that "harvestable" fish are present in Stout's Creek and reasonably assumes that these fish may be caught by individual anglers. Also, the HHRA carefully evaluates the number of "harvestable" fish of different species present in different reaches of Stout's Creek and concluded that sufficient fish are present to support ingestion rates of 1 and 3 g/day depending on the reach of Stout's Creek at which the fish are caught.

EPA agrees that the number of "harvestable" fish in BD-1, BD-2, and BD-3 can support one, two, and one angler at the reach-specific ingestion rates considered in the HHRA (see Section 5.5.4 of the HHRA). EPA does not believe that consideration of potential exposures by a few individuals with regard to a particular exposure pathway is "not consistent with typical risk assessment approaches." Community concern regarding potential ingestion of fish from Stout's Creek is well established, especially in light of similar concerns at other Bloomington area sites. EPA believes that the evaluation of potential ingestion of fish from Stout's Creek is consistent with a conservative, health-protective RME methodology. EPA will clearly state in the proposed plan that the predicted fish ingestion risks presented could only occur for one individual in reaches B-1 and BD-3, and two individuals in BD-2. EPA agrees that "this information will allow risk managers who review the risk assessment to make informed decisions, taking into consideration the size of the population that is potentially at risk."

The HHRA already addresses various uncertainties associated with the assumption that fish as small as 3-inches in length are "harvestable." Specifically, the HHRA notes that "fish tissue EPCs based on analysis of fish 4 inches or more in length are expected to overstate the concentration of PCBs in the tissue of fish between 3 and 4 inches long." The HHRA also discusses the fact that Stout's Creek is not a particularly desirable fishing location. As noted above, the HHRA is evaluating potential ingestion of fish by one or two individuals. EPA continues to believe that it is not unreasonable to assume that "harvestable" fish (including fish between 3 and 4 inches long) may be regularly caught in Stout's Creek and consumed. Finally, EPA disagrees that it would be "extremely difficult" to remove edible tissue from fish between 3 and 4 inches long. The difficulty should be similar to that associated with removing edible tissue from fish 4 inches long (the minimum length assumed by CBS to be harvestable).

Comment 231: EPA has used an exposure duration of 30 years. While it is conceivable that an individual could fish Stout's Creek every year for 30 years, it is highly unlikely that this would occur. Instead, an individual who regularly fishes from year to year is likely to be an avid sport angler who will visit higher quality fisheries during regular fishing trips. While it is possible that an individual might fish with this duration, it should be noted that this assumption is highly conservative and likely overstates potential for risk.

Response: EPA's use of a 30-year exposure duration is consistent with long-established residential exposure duration under RME conditions. An individual angler may fish a particular stream or a particular stretch of a stream for a variety of different reasons; in fact, these reasons may change during different periods of that angler's life. For example, an angler may fish in a particular stream (for example, Stout's Creek) based on its convenient location. Later in life, that same angler may continue to fish in Stout's Creek for nostalgic reasons; they have fished there in the past and continuing to fish in Stout's Creek may be relaxing and comforting. EPA has never asserted that anglers fish exclusively in Stout's Creek. Therefore, as suggested in CBS's comment, an avid sports angler may fish in higher quality fisheries in addition to Stout's Creek. However, EPA maintains that the assumption that an angler may fish in Stout's Creek to the extent necessary to meet the assumed fish tissue ingestion rates over a 30-year exposure duration is consistent with RME conditions.

Comment 232: EPA has limited its risk estimates for fish consumption to adults, but has conducted a semi-quantitative estimate of risk for young children based on an analysis of age-specific fish consumption rates and body weights. Based on this analysis, EPA has estimated that children may have higher risks than adults by a factor of roughly 2.

In this analysis presented in the HHRA, EPA took the rates of fish consumption that were provided for children aged 0-9 years and adults in Table 10-1 of EPA's Exposure Factors Handbook (EPA, 1997). The rates reported were the following:

	Intake g/person/day	
Receptor	Mean	95th Percentile
Child (0 to 9 years of age)	6.2	16.5
Adult (more than 20 years of age)	16.2	43.5

Then, to derive an estimate of relative dose on a body weight basis, the HHRA used a body weight of 15 kg for children and 70 kg for adults. When the ratios of intake rates to body weights for adults and children were compared, the ratio calculated for young children was determined to be higher than the ratio for adults by a factor of 1.8. The HHRA then went on, in an attempt to justify this finding, by comparing information in Table 10-61 of the same document, which reported mean fish intake by recreational angles on a body weight basis. When the fish intake for children aged 1 to 5 years was compared to fish intake for licensed anglers, the calculated ration indicated that children had a higher dose by a factor of 2.1.

This analysis is problematic for several reasons. First, the fish consumption rates used in both analyses are not representative of sport-caught freshwater fish. Second, the analysis erroneously assumes that average consumption for children aged 0-9 years is representative of consumption during each of those years. Third, the body weight used in the analysis, 15 kg, is the average body weight for children aged 1 to 6 years, not children aged 0-9 years upon whom the fish consumption rate is based. Finally, the confirmatory analysis, which is based on estimated rates from West et al. (1989) study, as interpreted by EPA (1997), is likely to be grossly inflated due to the methodology that EPA (1997) used to develop them for small children. Each of these issues is discussed below.

The first analysis conducted in the HHRA, using the fish consumption rates provided in the table above, was based on a study of seafood consumption conducted by the Tuna Research Institute, from which the data were subsequently analyzed and reported by Javitz (1980). These fish consumption rates were based on patterns of seafood consumption within the general population of the United States and were not representative of consumption of freshwater fish, as would be obtained from Stout's Creek or even consumption or recreationally caught fish. As a result, they include consumption of all types of commercially and recreationally available fish including such things a fish sticks and tuna, which are likely to be staples of the diets of young children but are not indicative of their consumption behavior of sport-caught freshwater fish. Similarly, while the rates of fish consumption reported in the West et al. (1989) study (which was used to corroborate the initial estimates) are based on a survey of recreational anglers, the rates themselves included consumption of all types of commercial and recreational fish within those households, and thus cannot be considered representative of consumption of sport-caught freshwater fish alone.

The difference in consumption of freshwater fish versus other types of fish is recorded in a study by Rupp et al. (1980), which used general population data collected by the National Marine Fisheries Service but broke the fish consumption rates out by age group, region of the country and type of fish (freshwater finfish, saltwater finfish, and shellfish). In that analysis, freshwater fish consumption by 1 to 11 year old children from the Eat North Central portion of the U.S. (which included Indiana) was reported to average 0.20 kg/year or 0.54 g/day. The average rate for adults reported by Rupp et al was 0.85 kg/year or 2.33 g/day. When consumption rates are adjusted for body weight for young children and adults, using age-specific body weights of 23.8 kg for 1 to 11 year old children (EPA, 1997) and 70 kg for adults, the result is 0.023 g/kg-day for 1-11 year old children and 0.033 g/kg-day for adults. Thus the relative intake for children aged1-11 years is only 70 percent of the rate for adults, indicating that intake rates for young children, and consequently exposure through fish consumption, are lower than those for adults, rather than higher, as reported in the HHRA.

The analysis in the HHRA also combines an average body weight for children aged 1 to 6 years with average consumption for children up to 9 years of age. This is inappropriate and skews the estimate substantially as it does not reflect the increase in relative consumption that is likely to occur as a child ages and grows. It is not reasonable to assume that a one-year old child, if he ore she eats fish at all, eats the same portion size as a 9 year old child.

The confirmation analysis conducted in the HHRA, based on the West et al. (1989) study is also biased due to the methodology that was used by EPA (1997) to derive those estimates. In the survey upon which those rates were based, survey respondents were asked to indicate which household members, including both adults and children, ate fish. However, when asked about the portion size for each meal, respondents were given a choice of indicating the fish meals were either less than, equal to, or greater than an 8 ounce serving that was depicted in a photograph included in the survey materials. It is likely that for young children, most respondents indicated that the portion size for younger children was "less than" the 8-ounce portion depicted. However, when the consumption rates wee estimated by EPA (1997), all responses that indicted that portions sizes were less than 8-ounces were assumed to be 5 ounces in size. While this may have been a reasonable assumption for adults, it is likely to grossly overestimate portion sizes for children aged 1-6 years who would have portion sizes substantially less than 5 ounces in size. Thus, these consumption rates are likely to be exaggerated overestimates for this age group and thus do not provide a reliable point of comparison.

The date provided in the EPA (2002) reported entitled "Estimated Per Capita Fish Consumption in The United States" can be used to clarify the relative intakes by young children and adults. While the consumption rates provided in that report cannot be considered representative of long term consumption rates, due to the fact that they are based on short-term data, they do provide a point of comparison by age group. Table 5 (p.4-16) of that report provides estimates of freshwater fish and shellfish consumption by children of different age groups (beginning at age 3) on a body weight basis, while Table 4 provides comparable rates for adults. Based on these reported rates, an estimated rate of children aged 3 to 6 years can be calculated as follows and compared with adult rates.

	Freshwater Fish and Shellfish Intake Rates (mg/kg-day)	
Age Group	Mean	95th Percentile
3-5 years	82.93	283.55
6-10 years	59.25	188.77
3-6 years*	77.01	257
Adults	74.58	502.20

Source: EPA (2002), Section 4.1.1.2, Tables 5 (children) and 4 (adults)
*Weighted average of 3 years at 3-5 year rate, and 1 year at 6-10 rate

As is clear from this comparison, the mean body weight adjusted intake rates for children aged 3 to 6 years are roughly the same as the body-weight adjusted rates for adults (ratio of 1.03). However, the 95th percentile rates reported for these age groups are substantially higher for adults than they are for 3-6 year old children. As a result, it can be concluded that risk estimates calculated for adult fish consumers at the Bennett's Dump Site should also be adequately protective of young children who may consume those fish.

Response: EPA acknowledges some inconsistencies and uncertainties associated with the methodology used in the HHRA to compare child and adult fish tissue intakes. EPA also acknowledges that the CBS analysis is mathematically correct. However, the CBS analysis misses the point. Rather than compare child and adult fish tissue intakes based on national or regional age group-specific mean or 95th percentile ingestion rates, as was done in the CBS analysis as well as the initial EPA methodology, comparisons must be made based on the fish tissue ingestion rates assumed for the HHRA.

Specifically, the HHRA assumes that one (BD-1 and BD-3) or two (BD-2) individuals may consume 1 g/day (BD-1 and BD-3) or 3 g/day (BD-2) without adversely impacting the sustainability of the harvestable fish population in Stout's Creek. The HHRA calculated exposures for adult receptors only; however, the individual consuming the fish could just as easily be a child (1 to 6 years old). Therefore, the first step of the comparison is to calculate the body weight adjusted fish intake rates for child (age 1 to 6 years) and adults based on the daily fish tissue ingestion rates assumed for the HHRA. These calculations are presented in the table below.

Parameter	BD-1 and BD-3		BD-2	
	Child (age 1 to 6 years)	**Adult**	**Child (age 1 to 6 years)**	**Adult**
Fish tissue ingestion rate (mg/day)	1,000	1,000	3,000	3,000
Body weight (kg)	15	70	15	70
Age-adjusted fish tissue ingestion rate (mg/kg-day)	67	14.3	200	42.9
Ratio of child and adult age-adjusted fish tissue ingestion rate	4.7		4.7	

In order to evaluate the validity of the calculated ratios, the reasonableness of the child (age 1 to 6 years) and adult age-adjusted fish tissue ingestion rates was evaluated. Rupp and others (1980) the 90th and 99th percentiles of freshwater fish consumption by 1 to 11 year old children from the East North Central portion of the U.S. (which included Indiana) was reported to be 0.55 and 3.06 kg/year, respectively. Based on a body weight for this age group of 23.8 kg (Table 7-3, EPA 1997) the 90th and 99th percentile age-adjusted fish intakes rates for children 1 to 11 years of age (calculated as daily fish ingestion rate [mg/day]/body weight [kg]) are 63.3 and 352 mg/kg-day, respectively.

The age-adjusted fish tissue ingestion rates presented in the table below for children (age 1 to 6 years) fall within this range. However, this result must be further evaluated. First, consistent with an evaluation of RME conditions, the most appropriate fish tissue ingestion rates would be representative of 95th percentiles. However, Rupp and others (1980) does not present this information. Based on the information presented in Rupp and others (1980), the 95th percentile age adjusted fish intake for children 1 to 11 years of age is between 63.3 and 352 mg/kg-day.

Children 1 to 6 years of age are likely to ingest less fish (in terms of total mass consumed) than children 1 to 11 years of age. How much less is not known. However, the body weight for children 1 to 6 years of age (15 kg) is less than the body weight for children 1 to 11 years of age (23.8 kg). It should be noted that the mean fish intake (g/kg-day) among individuals who eat fish and reside in households with recreational fish consumption is higher for children 1 to 5 years of age as compared to children 6 to 10 years of age (see Table 10-61 in EPA 1997). This result indicates that the mean fish intake for children 1 to 6 years of age would exceed the mean fish intake for children 1 to 11 years of age.

Altogether, this discussion suggests that the body weight adjusted fish intake rates for children 1 to 11 years of age calculated from information presented in Rupp and others (1980) (see the table above) are adequately representative (though they may be lower than) of body weight adjusted fish intake rates for children 1 to 6 years of age. Therefore, it is reasonable to assume that children 1 to 6 years of age may ingest fish at 1 g/day (BD-1 and BD-3) or 3 g/day (BD-2) under RME conditions.

Similarly, Rupp and others (1980) report the 90^{th} and 99^{th} percentile of freshwater fish consumption by adults (18 to 98 years) from the East North Central portion of the U.S. (which included Indiana) was reported to be 2.28 and 9.40 kg/year, respectively. Based on a body weight for this age group of 70 kg (EPA 1997) the 90^{th} and 99^{th} percentile age-adjusted fish intakes rates for adults (calculated as daily fish ingestion rate [mg/day]/body weight [kg]) are 89.2 and 368 mg/kg-day, respectively. The age-adjusted fish tissue ingestion rates calculated for Stout's Creek are below this range. Therefore, adult receptors can certainly consume fish at 1 g/day (BD-1 and BD-3) or 3 g/day (BD-2) under RME conditions.

In conclusion, the analysis presented above indicates that the age-adjusted fish tissue ingestion rates presented in the table above for children 1 to 6 years and adults are consistent with and sustainable under an RME scenario. If a child who is 1 to 6 years of age consumes the same of mass of fish (e..g, either 1 or 3 g/day) as an adult, the child's intake of PCBs, after adjusting for his or her weight, will be almost 5 times greater than that of the adult. EPA's previous estimate that a child's intake (and associated hazards) will be about twice those calculated for adults is an underestimate. EPA will revise the proposed plan accordingly.

Comment 233: Tetra Tech has based its surface water exposure evaluation on the maximum surface water concentration detected immediately downstream of the Site, despite an acknowledgment (pp. 14 and 33) that this concentration is not representative of either the long-term surface water concentration to which recreationalists might be exposed, or of maximum conditions in locations downstream of the sampling location where concentrations are likely to be lower than they are immediately adjacent to the landfill.

In evaluating potential exposures to surface waters, EPA has developed a chronic exposure model that assumes that individuals are exposed for either 12 years (youths) or

30 years (adults). As acknowledged in the HHRA, surface water concentrations over an extended period of time will be most closely approximated by the average values over time. For Stout's Creek, there are five years of water sampling data available. Annual average surface water concentrations ranged from 0.16 [microgram per liter] μg/L in 2000 to 0.38 μg/L in 2004 immediately adjacent to the site, with an overall 5-year average of 0.27 μg/L. This value is more suitable as the EPC for this evaluation. Alternatively, as the HHRA reports that average concentrations appear to have increased every year during the 5-year period, it may also be appropriate to use the maximum of the average yearly concentrations measured as the EPC. If this number were to be selected, the EPC for the surface water evaluation would be 0.38 μg/L based on the data for 2004. Either of these sample concentrations could be considered representative of concentrations in a very short section of the Creek immediately adjacent to the landfill.

These concentrations are not, however, representative of concentrations in BD-1, BD-2, or BD-3, which are the reaches of focus in the HHRA. In these reaches, which are downstream of the source area, the stream is larger and there is more dilution with runoff and contributions from smaller tributaries. Thus, water concentrations will be substantially lower there than they are adjacent to the source area. The use of these concentrations to represent potential exposures downstream, where exposures are more likely to occur, substantially overestimates potential exposures in those areas.

Water samples collected by CBS in reaches BD-2 and BD-3 have demonstrated that PCBs are not detectable (at a detection limit of 0.02 μg/L) in these reaches. In addition, stream flow measurements have indicated that the flow in BD-1 is twice the flow at the sampling location upon which the HHRA has based its EPC. At a minimum, based solely on dilution, one would expect the concentration in BD-1 to be half that of the concentration measured adjacent to the landfill. Using the highest average concentration reported in the HHRA, 0.38 μg/L, one would estimate the maximum water concentration in BD-1 to be no more than 0.19 μg/L. For BD-2 and BD-3, where water samples have been non-detect (<0.02 μg/L), an estimated concentration of one-half the detection limit, or 0.01 μg/L, would be most appropriate as the EPC.

Response: The EPA used the maximum detected concentration of PCBs as the surface water EPC consistent with an initial conservative, health-protective approach. While EPA acknowledges that receptors will not be repeatedly exposed to the maximum detected total PCB concentration, EPA believes it is reasonable to assume that human receptors, particularly those who will live in the proposed Stoneybrook Park Subdivision to be located immediately south and west of the site between State Routes 37 and 46 and south of Arlington Road, may regularly recreate and potentially have direct exposure to surface water and sediment in Stout's Creek at a point close to the development. (Note: additional indirect exposure is assumed to occur through ingestion of fish caught downstream of the landfill at BD-1, BD-2, and BD-3.

Therefore, EPA has recalculated the surface water EPC as the 95 percent upper confidence limit of the mean (95 UCL) based on the same 5 years of surface water analytical data considered in the HHRA (analytical data collected from November 1999 through June 2004 at the Stout's Creek downstream locations) (Viacom 2005c). This approach is consistent with EPA guidance (EPA 1992, 2002). EPA calculated the 95 UCL using its ProUCL software (EPA 2004) as shown in Attachment 1. It should be noted that duplicate results were averaged and considered as a single analytical result consistent with EPA guidance (EPA 1989). Revised surface water risks and hazards were calculated based on the new surface water EPC, 0.32 μg/L. The revised surface water risks and hazards are approximately 25 percent of those presented in the HHRA (0.32/1.2).

Comment 234: The HHRA uses an extremely high exposure frequency of 68 days/year for the surface water exposure pathways. This frequency is based on the assumption that adult and youth recreationalists will spend 4 days per week for 13 weeks, from June through August, and 4 days per month at the Site during April, May, September, and October. This is no indication that this level of recreational activity is occurring along the Creek or would be likely to occur in the future. In fact, it is not likely that an individual would engage in regular recreational activity along the creek, due to its small size, the extreme limitations on access presented by steep banks in most areas, and the high degree of vegetation and overgrowth along those banks. Thus it would be more reasonable to assume that individuals could potentially visit this area once per week during these months, for a total of 30 days per year. This exposure frequency is similar to the exposure frequency of 36 days /year that EPA used to evaluate potential upper-bound exposures to sediment by adults and children aged 7 to 18 along the Housatonic River in Massachusetts (EPA, 2005), which is a substantially larger and more attractive recreational area than is Stout's Creek. The central tendency exposure frequency used in that risk assessment was 12 days/year. An exposure frequency of no more than 36 days per year would be most appropriate and representative of the potential for exposures at this Site.

Response: EPA is concerned about potential exposures throughout Stout's Creek downstream of the site. However, it is not unreasonable to expect that residents of the new development may choose to visit and recreate in and along Stout's Creek at a nearby location. In fact, the proximity of a small stream may be one reason some residents choose to live in the new development. To the extent that is the case, it is reasonable to assume residents will visit the stream more frequently than otherwise expected. While other surface water bodies may have a higher overall attractiveness, Stout's Creek is the "local" stream and its proximity and a sense of ownership by nearby residents cannot be overlooked. Also, EPA expects that exposure frequency will increase during the summer months, when the heat will make the stream water more attractive. The HHRA is intended to address a RME scenario. That is, not all individuals may be exposed as frequently as assumed, but EPA believes it is reasonable to assume some individuals may be exposed as often as 68 days/year.

Comment 235: EPA has used an exposure time of 2 hours/day to evaluate dermal exposure to surface water. This is a highly inflated estimate of the amount of time that individuals are likely to wade at the Site, particularly when considered in light of the exposure frequency of 68 days/year that is used in the assessment. It is highly unlikely that an individual would spend this amount of time in the water from April through October. This is particularly true for older youths and adults who are not likely to spend substantial amounts of time in the water, even when visiting the creek.

Give the size of the creek and its lack of appear as a recreational location, it seems more reasonable to assume that an individual spends no more than one hour in contact with the surface water during every exposure event. Even this assumption would be likely to overestimate potential for contact for this exposure pathway.

Response: EPA acknowledges that the assumption that individuals are exposed for 2 hours/day on each day of exposure is conservative. In light of EPA's intention to retain an exposure frequency of 68 days/year, EPA is revising its exposure time assumption from 2 to 1 hour/day. Exposures, risks, and hazards associated with dermal exposure to surface water are revised accordingly.

Comment 236: EPA has selected a water ingestion rate of 0.0382 L/day for adults and 0.0765 L/day for youths, based on swimming. They have derived these water ingestion rates by using the incidental ingestion of 0.05 L/hour (EPA, 1989) for an exposure time of 2 hours to derive a total of 0.1 L/day. For youths, they have assumed that individuals will only ingest water during the summer months (13 weeks or 52 visits if there is a visit four day/week) and thus have adjusted the ingestion rate by a factor of 52/68 so that they can combine this ingestion rate with a frequency of 68 days/year to derive their water ingestion rate. EPA has then assumed that adults will ingest water for approximately half of the time that youth receptors will. This approach is unnecessarily convoluted and does not reflect potential for exposure due to this pathway.

EPA has clearly acknowledged that the potentially exposed individuals who visit the creek will not swim in the creek. In fact, it would be unusual for and individual to ingest any surface water while visiting a creek that is as shallow as Stout's Creek. As a result, the only occasion that an individual may have an opportunity to ingest water will be if that individual were to fall into a deeper pool and accidentally swallow some water. It would not be anticipated that this accidental exposure would happen every time an individual visited the creek. Instead, it is possible that this type of accidental exposure might occur one or two times per year. Using the approach that has been used in the HHRA, if it is assumed that an individual falls into the water two times during the year and incidentally ingests 50 [milliliter] mL of water during each fall, the long-term average water consumption rate will be 1.5 mL/day (50 mL * 2/68). This is a more realistic, but still highly conservative, water ingestion rate for both youth and recreationalists.

Response: EPA agrees that the approach used to calculate the rate of potential surface water ingestion rate was convoluted. Further, because the methodology assumed exposure during swimming (an activity that was not assumed to occur), this approach did not adequately reflect site-specific conditions.

However, EPA disagrees with CBS's assumption that "it would be unusual for an individual to ingest any surface water while visiting a creek that is as shallow as Stout's Creek." Individuals recreating in or along Stout's Creek may ingest surface water by scooping water from the creek to their mouth. One fluid ounce of water is equivalent to 29.6 mL. EPA considers one fluid ounce to be a reasonable amount of water to assume an individual ingests to temporarily alleviate a thirst they may have especially on warmer days. EPA also assumes that youths may ingest water in this fashion on 50 percent of the 68 days/year they are assumed to recreate in or along Stout's Creek. Adults are assumed to ingest water from the creek half as often as youths. Therefore, receptor-specific revised surface water ingestion rates are calculated below.

Youths

(0.030 L/day x 34/68) = 0.015 L/day

Adults

(0.03 L/day x 17/68) = 0.0075 L/day

These receptor-specific surface water ingestion rates are less than those assumed in the HHRA. Therefore, revised exposure, risks, and hazards are calculated by multiplying the values presented in the HHRA by the following ratios of surface water ingestion rates.

Youths

Adjustment factor = (0.015 L/day)/(0.0765 L/day) = 0.196 (or 0.2)

Adults

Adjustment factor = (0.0075 L/day)/(0.0382 L/day) = 0.196 (or 0.2)

Comment 237: EPA has assumed that feet and lower legs are in contact with the water for all modeled exposure events. While individuals could wade in the stream every time they were in the vicinity of the creek, it is unlikely, for several reasons, they will wade in water up to their knees every time they are there.

First, according to information recorded by Tetra Tech (2004), much of the stream is very shallow. Thus, in most cases, except some of the deeper pools, it is likely that only the feet and ankles would be in contact with surface water during wading. While some of the deeper pools would allow individuals to have their feet and entire lower legs in contact with surface water, it is unlikely that this would occur during every wading event modeled or would continue for two hours, as suggested in the HHRA. Thus a more reasonable assumption would be to assume that only the feet and half of the lower lets are in contact with surface water during each event. For 7 to 18 years old recreationalists, this would result in a more realistic exposed surface area of 1,884 [square centimeters] cm2. For adults, this would result in a surface area of 2,410 cm2.

Second, it is not likely that individuals as old as 18 years of age would engage in this type of wading behavior. While it may be reasonable to assume that pre-adolescents between the ages of 7 and 13 years might be engaged in recreational activities that would involve regular wading, once children reach high-school age, this type of activity is likely to lose its appeal on a regular basis. As a result, the assumption that these behaviors occur every year for 12 years is likely to substantially overestimate exposure to those individuals.

Response: EPA is aware of the generally shallow water depth in Stout's Creek outside of some deeper pools. However, the amount of skin surface area potentially exposed by wading in the creek does not necessarily have to correspond exactly to the depth of the water in the creek. It is expected that skin surface areas above the water depth may become exposed as a result of splashing resulting from wading or other recreational activities. Also, other body parts (for example, hands and forearms) may become exposed as the result of reaching into the water to retrieve objects or explore the creek bed. It is difficult to anticipate the amount to time and precise amount of skin surface area exposed in these instances. Therefore, it was assumed that the feet and lower legs of an individual are exposed during each visit to the creek.

EPA acknowledges that teenagers and adults may find wading or playing in and along the creek less appealing than pre-adolescents. However, this observation is not an absolute. Therefore, consistent with an RME approach, EPA will continue to assume that individuals 18 or more years of age will engage in wading behavior. EPA will address the uncertainty associated with this assumption in the risk assessment uncertainty discussion.

Comment 238: While the sediment contact pathways are not important pathways in terms of their contribution to total risks, the risk estimates for this pathway are overstated. This is because the analysis uses (1) the maximum sediment concentration from the reach closest to the source (BD-1), (2) a very high exposure frequency of 68 days/year (as discussed in the preceding comments for the surface water pathways), (3) an inflated sediment ingestion rate that is not supported by the EPA guidance upon which it is purportedly based, and (4) an unreasonably high dermal adherence factor for youths, for which one would not expect dermal adherence of sediment to be any greater than it would be adults. However, the low risks that have been predicted in the HHRA for sediment contact pathways (cancer risk of 8.2E-08 and hazard index of 0.005 for all reaches), despite the use of these very conservative assumptions, indicate that sediments at the site do not pose a risk to the receptors evaluated. Any refinement of the exposure parameters to make them ore site-specific and relevant will further reduce risks. Thus it is not necessary or fruitful, from a risk point of view, to provide additional comments on these pathways.

Response: The EPA used the maximum detected concentration of PCBs as the sediment EPC consistent with an initial conservative, health-protective approach. However, as noted above for potential surface water exposure, "receptors will [not] be repeatedly exposed to the maximum detected total PCB concentration." Again, as noted above with regard to potential surface water exposure, EPA believes it is reasonable to assume that human receptors, particularly those who will live in the proposed Stoneybrook Park Subdivision to be located immediately south and west of the site between State Routes 37 and 46 and south of Arlington Road, may regularly recreate and potentially have direct exposure to surface water and sediment in Stout's Creek at a point close to the development. (Note: additional indirect exposure is assumed to occur through ingestion of fish caught downstream of the landfill at BD-1, BD-2, and BD-3.

EPA would have further refined the sediment EPC if the initial conservative calculations had demonstrated potentially significant risk (greater than or equal to 1E-06) or hazard (greater than or equal to 1). However, as noted by CBS, the risk and hazard results presented in the HHRA related to potential sediment exposures are insignificant.

EPA believes that an exposure frequency of 68 days/year is consistent with a RME scenario as described above for potential surface water exposures. EPA also believes that the sediment ingestion rate used in the HHRA is reasonable and consistent with EPA guidance. CBS provides no specifics to support their opinion that the sediment ingestion rate is not consistent with EPA guidance.

EPA agrees with CBS's conclusion that sediment risks and hazards could be adjusted by refining (and potentially lowering) the sediment EPC; however, this effort would not be particularly helpful as the risks and hazards calculated using the conservative sediment EPC are insignificant.

Comment 239: In an effort to demonstrate the degree of overestimation of the risk estimates provided in the HHRA, AMEC has recalculated potential risks to thee receptors using the recommended assumptions outlined and discussed above.

Response: Because EPA does not agree with many of CBS's proposed parameter value revisions, review and comment on AMEC's revised risk estimates is not warranted. However, EPA has recalculated potential risks to adult, youth, and child receptors using the revised assumptions discussed above in EPA's responses. EPA's revised risk and hazard estimates, and the basis for each, are provided in the following sections.

EPA's revised risk and hazard calculations are presented in Attachment 2. Attachment 2 contains tables summarizing revised fish tissue EPCs (Table 1), revised fish tissue risks and hazards (Table 2), revised total risk estimates (Table 3), and revised total hazard estimates (Table 4). Also, it should be noted that documentation for the revised surface water EPC (0.32 μg/L) is presented in Attachment 1.

Comment 240: Section 5.3 of the HHRA reports that the levels of PCBs in the fish tissues indicate that the surface water likely exceeds the AWQC for PCBs. It states that PCB levels in fish tissues would need to be 0.025 mg/kg in order to be in compliance with the AWQC. However, as noted previously by CBS (2005), if the level of fish consumption that is supportable by a small creek is less than the 6.5 g/day that has been used to derive the AWQC, that criterion should have little bearing on future risk management decisions. As has been demonstrated above and in the HHRA, the reaches of Stout's Creek that have been evaluated are not adequately productive to support a fish consumption rate of 6.5 g/day.

Response: The applicability of the State of Indiana's AWQC and fish consumption advisories to Stout's Creek and other Bloomington area streams is discussed in Section 5.5.6 of the HHRA. As of the date of this responsiveness summary, EPA assumes that the State of Indiana's AWQC and fish consumption advisories are applicable to Stout's Creek and can be used to assess the presence and magnitude or risks and hazards associated with potential ingestion of fish from'Stout's Creek.

Comment 241: EPA has noted that the "Great Lakes states such as Indiana use a PCB action level of 0.05 mg/kg for fish tissue to trigger fish consumption advisories" and state that such an advisory is present for Stout's Creek. This is not completely accurate. While the HHRA states that the average concentration of PCBs in fish tissues in Stout's Creek exceeds the state fish advisory level of 0.05 mg/kg, it fails to point out that this advisory level is based on unlimited consumption and is not in place for Stout's Creek. In fact, the 2005 advisory for Stout's Creek that was published by the Indiana Department of Environmental Management ("IDEM") is a Group 3 to Group 5 advisory which recommends that no more than 1 meal/month of creek chub greater than 8 inches in length be consumed from Stout's Creek and lesser amounts of larger creek chubs (www.state.in.us/isdh/dataandstats/fish/2005). During the 2004 fish sampling effort, however, CBS found no creek chub greater than 6 inches in length indicating that it is rare that creek chub larger than this length are present in the creek and thus cannot be consumed from it at any reasonable rate. While it is possible that there could be a few creek chub of this size in the creek, it is unlikely that there are adequate numbers of these fish to raise these consumption advisories to an issue for risk management decisions.

In addition, according to the methodology used to derive the Great Lakes Advisories, an individual can safely eat up to six half-pound meals per year (equivalent to 3.7 g/day) if the fish tissue concentrations of PCBs do not exceed 1.9 mg/kg. As demonstrated in the HHRA and in the above analysis, these reaches cannot support consumption higher than this, even for just one individual. In addition, the EPCs calculated for sunfish and for sucker/sunfish combined are well below this concentration.

Response: The applicability of the State of Indiana's AWQC and fish consumption advisories to Stout's Creek and other Bloomington area streams is discussed in Section 5.5.6 of the HHRA. As of the date of this responsiveness summary, EPA assumes that the State of Indiana's AWQC and fish consumption advisories are applicable to Stout's Creek and can be used to assess the presence and magnitude or risks and hazards associated with potential ingestion of fish from Stout's Creek.

Comment 242: One commenter states, "[a]s you read on, you learn that sediment, mentioned in the first sentence as part of the Preferred Remedial Alternative has been removed from further consideration because EPA has determined that it does not pose an unacceptable risk to human health or the environment." Yet later on within the Proposed Plan the word "sediment" is referred to in a way that seems to make EPA ambivalent about sediment.

Response: The U.S. EPA is not ambivalent about the presence of sediment at the Bennett's Dump site. In fact, sediment at the site has been sampled and analyzed for PCBs. The commenter is referred to the sampling results in Stout's Creek which show PCBs under 1 ppm and at levels that would not present an unacceptable risk. Therefore, it was determined that a sediment cleanup would not be necessary.

Comment 243: EPA's braggadocio (and wholesale promises) for its Preferred Remedial Alternative on the front page of the Proposed Plan, smacks of mind control, while its Preferred Alternative which we find eventually on page 12, turns out to be, after 7 or 8 years of global negotiations with CBS/VIACOM, a hypothetical non-remedy, although assuredly cost-effective for the Principal Responsible Party!

Response: EPA disagrees with the commenter. EPA is unsure what the commenter is referring to as "mind control." The implementation of the passive quarry drain and interceptor trench with water treatment is not a hypothetical non-remedy.

Comment 244: The Remedial Action Objectives, 3 in number, were not encouraging:

----- Reduce the amount of PCBs released from groundwater to Stout's Creek through mass reduction.

----- Improve PCB levels in fish for beneficial reuse by reducing PCBs released to Stout's Creek

----- Reduce the amount of PCB mass in sediments that may be available to fish by reducing PCBs released to Stout's Creek.

"Reduce" is the key word, but how much reduction of "PCB levels" will it take to make them edible again in Stout's Creek where the fish have been essentially inedible since Westinghouse started dumping capacitors at Bennett's Quarry Dump nearly 40 years ago. This is supposed to be a "final Remedial Action" for cleanup of Bennett's Dump. The Proposed Remedy should be capable of making fish edible again in Stout's Creek.

Response: Based upon the fish sampling data from Stout's Creek and the State of Indiana Fish Advisories, the fish can be eaten from Stout's Creek but only one meal per month. In addition, the EPA refers the commenter to the human health risk assessment for additional information on the risk associated with eating fish from Stout's Creek. EPA is of the opinion that with the implementation of the passive quarry drain and interceptor trench, with water treatment will reduce the PCB levels in fish within Stout's Creek. EPA would also like the have individuals who fish be able to eat fish more frequently from Stout's Creek.

Comment 245: One commenter states EPA officials are frustrated by the failure of the source control operable unit excavations conducted in 1999 at Bennett's quarry Dump, Neal's Landfill, and conducted in 2000 at the Lemon Lane Landfill. The commenter continues that the failure was not publicized, and PCBs are discharging into Stout's Creek at levels that are the same those prior to the excavation of the site and operable units 2 and 3 are being used to compensate for the failure of the first operable unit.

Response: The source control operable unit did not "fail" at Bennett's Dump. The large excavation reduced the on-site risk with commercial/industrial development possible at the site. The continuing release of PCBs into Stout's Creek was not anticipated before the excavation, but EPA addressed the problem through CBS doing a groundwater and sediment investigation with EPA subsequently choosing additional remedies. EPA is somewhat puzzled by the commenter with the suggestion that the failure was not publicized. EPA completed a Five-year Review describing the continuing problems with the continuing releases. Bennett's Dump has been discussed publicly at every Citizens Information Committee meeting.

Comment 246: One commenter states that the hotspot investigation at Bennett's Dump and other Bloomington PCB sites was not complete and has come back to haunt EPA. In addition, the commenter states that other buried quarry pits were used for disposal based upon the commenters discussion with an individual who was involved in the initial capping of the site by EPA. The commenter continues with stating that "Given so many scientific uncertainties, it seems time to bring some karst hydrologists in to study the Bennett's Dump Area prior to a decision to construct an engineering solution that is only conceptual and has not even reached a preliminary planning stage."

Response: Bennett's Dump did not have a hot spot removal and capping remedy like those completed at Neal's Landfill and the Lemon Lane Landfill. Instead, the Bennett's Dump site was remediated to commercial/industrial PCB standards. The governmental parties and CBS have investigated other open, water filled quarry pits during the investigation of the Bennett's Dump site. Ice box quarry was drained by Star Stone a few years ago and no capacitors were observed. We have sampled water in Icebox Quarry and PCBs have been detected, but this contamination is from groundwater. Water samples at the Wedge Quarry complex have shown no detections of PCBs in the water. EPA is aware of an area called Mule Hole near the Bennett's Dump site (now the intersection of 46 and 37) and this area was investigated and determined not to contain PCBs or PCB capacitors.

EPA is puzzled by the commenters statement that a karst hydrologist should study the site prior to constructing an engineering solution. EPA has used a karst geologist/hydrologist for all the Bloomington PCB sites. In addition, EPA has discussed the remedy with COPA's karst hydrogeologist. The Bennett's Dump groundwater has been studied extensively (please see the EPA Status Report) and the groundwater remedy proposed is not conceptual. The long-term pump down test clearly showed the reduction in spring flow and the technology of using a collection trench and carbon adsorption are implementable. EPA is of the opinion that the remedy is feasible but the design has not been completed. The approach of doing pre-design work and then design is very common for Superfund sites.

Comment 247: One commenter states that Alternatives 1, 2, and 3 are meaningless alternatives, but states Alternative 4 is meaningful as it involves excavating the identified buried quarries and includes searches for other disposal areas to excavate.

Response: The commenter is incorrect in stating that Alternatives 1 through 3 are meaningless. EPA, however, is of the opinion that these three remedies would not produce the required risk reduction. The investigation of Bennett's Dump clearly showed that reducing the elevation of water in the Wedge Quarry complex reduced the spring flow at the Bennett's Dump site. Both short-term and long-term testing was completed to make this remedy viable. The commenter is unfamiliar with CERCLA since Alternative 1 – No Action is required to be evaluated.

Comment 248: One commenter states that EPA's preferred alternative (Alternative 5) is conceptual and EPA does not provide evidence that it will work. The commenter continues with the question if the passive quarry drain does not work or is flawed, then what happens to the remedy.

Response: The commenter is incorrect in stating that Alternative 5 is conceptual. The feasibility of implementing Alternative 5 has been completed and EPA is of the opinion that the remedy can be successful. The passive quarry drain has been evaluated with both a long-term and short-term pump tests and the results indicted that it is very feasible. The commenter is referred to document number 108 in the Administrative Record which reports the results of the long-term pump down test. In the unlikely event the passive quarry drain does not work, then EPA will reevaluate the site remedy.

Comment 249: One commenter asks whether an 8-foot deep trench will be sufficient given the depth of the quarries and the groundwater in that area. It would seem to need to be deeper to capture all discharges from the springs at the site as well as to collect contaminated groundwater that may be emerging from springs in and along Stout's Creek.

Response: As stated in the Proposed Plan, the 8-foot deep trench is a proposed depth but based upon the design, the trench depth may change. The commenter is correct that the final depth may require the trench to be deeper but the commenter gives no reason why they think the depth should be deeper. The final trench depth will be determined by the pre-design and design and will be based on conditions found at the site.

Comment 250: One commenter states that EPA has ignored volatilization of PCBs, especially when the water is turbulent.

Response: EPA has not ignored volatilization. EPA has evaluated the past air sampling data during the excavation phase and the PCB levels in the spring water and determined that volatilization of PCBs would not be at levels producing an unacceptable risk. In addition, EPA in the human health risk assessment evaluated what the PCB levels in air would have to be to affect the inhalation pathway and determined that the levels in the water would not produce PCB air levels at unacceptable risk.

Comment 251: One commenter states that EPA must consider the nature of the type of springs and the commenter quotes the COPA hydrogeologist who states "Since all the springs at the site cease flowing and it is likely that the aquifer does not cease flowing and the springs are of the "overflow" type, that therefore the "baseflow" must be discharging elsewhere. If this base flow component has not been identified it will have to be if the migration and discharge of contaminants are to be properly understood. Smart (1982) and Worthington, 1991) describe overflow and underflow springs, but a century earlier Martel (1893) did so also, so there is nothing surprising and strange about this phenomenon. The vertical hierarchical nature of surface discharge from carbonates may qualify as one of the most misinterpreted phenomenon in hydrogeology. A spring can be recognized as an overflow type by a large variation in discharge or by the fact that the spring ceases to discharge at any time. A baseflow or underflow spring has a constant discharge and discharges constantly."

Response: Please see response to Comment 257.

Comment 252: One commenter requests that Alternative 5 be withdrawn since it will not work in karst terrain since you cannot control karst, cannot manipulate karst and cannot predict karst in any way shape or form. The only alternative to be considered the commenter continues is the complete removal of PCB contaminated soils and then the consideration of water treatment as a follow up residual removal action.

Response: EPA will not withdraw Alternative 5 and based upon the analysis of nine criteria, Alternative 5 is the remedy EPA will implement. The comment that karst cannot be manipulated or predicted in any way, shape, or form is not based on fact. Considering a majority of Bloomington and southern Indiana is over karst terrain does not support the commenter. The comment is also puzzling since water treatment, which previously the commenter indicated would not work is supported. EPA does not believe that additional excavation in the buried quarry pits would eliminate the need for water treatment, because of the PCBs are in the bedrock and not in a form or location that can be easily reached and excavated. Further, the difficulty of excavating former buried quarry pits for a small amount of PCB removal is not justified.

Comment 253: One commenter states "In general we are supportive of Alternate 5: Passive Quarry Drains with Interceptor Trench and Carbon Treatment. While we are in general support that Alternative 5 is protective of human health and the environment, is feasible and is cost effective, we strongly suggest that EPA consider additional excavation of the buried quarry pits to a depth and scope that is feasible. Removal of additional source PCBs would in the long run reduce the amount of PCBs released into the environment and therefore needed to be treated."

Response: Additional excavation in the buried quarry pits would not eliminate the need for water treatment. Moreover, due to the difficulty of excavation within the buried quarry pits and the low level of contamination at depth, the low levels of PCBs that are being released are best addressed through use of the passive quarry drains and interceptor trench.

Comment 254: One commenter states there is also concern that if the Interceptor Trench does not adequately catch all known and unknown releases, the EPA will at some point need to address the buried pits, and because they failed to excavate under terms of the current negotiations with CBS, EPA and the other governmental parties would then be liable for the full cost of such excavation.

Response: *If the interceptor trench for some reason does not capture the releases,* EPA may then use the reopener provision in the Consent Decree to force CBS to address the unknown conditions, or may use any of its other enforcement tools to ensure a protective remedy.

Comment 255: COPA would like to commend EPA for diligence in working to protect the public by not leaving us with the initial Bennett's remedial activities and for continuing to test, monitor and study contamination from Bennett's.

Response: The EPA would like to thank COPA for its continuing effort to keep the citizens informed on the PCB issues in the Bloomington, Indiana area.

Comment 256: The reference to spring locations being different from historical locations seen on aerial photographs is probably normal, springs discharge where the resistance is least. When spring orifices become overgrown, collapse or are covered by work activities the discharge moves to where the resistance is least.

Response: EPA agrees.

Comment 257: Since all the springs at the site cease flowing and it is likely that the aquifer does not cease flowing and the springs are of the "overflow" type, and therefore the "baseflow" must be discharging elsewhere. If this baseflow component has not been identified it will have to be if the migration and discharge of contaminants are to be properly understood. Smart (1982) and Worthington (1991) describe overflow and underflow springs, but a century earlier Martel (1893) did so also, so there is nothing surprising and strange about this phenomenon. The vertical hierarchical nature of surface discharge from carbonates may qualify as one of the most misinterpreted phenomena in hydrogeology. A spring can be recognized as an overflow type by a large variation in discharge or by the fact that the spring ceases discharging any time. A baseflow or underflow spring has a constant discharge and discharges constantly. Springs also sometimes discharge overflow components even though they discharge baseflow components themselves.

The statement "this flow pattern indicates that the springs are not fed by conduits in the karst bedrock" is illogical and impossible. If a spring exists then there must be a conduit that it is discharging from. Quinlan et al., (1996) cite that turbulent flow at a velocity of 0.001 m/s (about 90 m/day) is possible from a conduit a few millimeters in diameter. Conduits this small The problem is that the nature of springs their variability and discharge has been misunderstood. [Sic] Shuster and White (1971) described chemical variability of springs to be related to aquifer differences, and that low variable springs or discharge from aquifers without conduits. Even though in the same year Newson (1971) showed that there was a strong relationship between spring (chemical) variability and the percentage of sinking stream water in the catchment, (and said there was no evidence that there were differences in the aquifers, his paper was published in the geographic literature and many geologists and hydrogeologists never enlightened themselves to his thinking. In 1992 Worthington et al., wrote a paper with the idea of resolving this kerfufle showing that spring chemographs were very closely related to the percentage of allogenic (sinking stream) water, using a larger data set that included that of Shuster and White and Newson. Significantly, they showed in the Mammoth Cave aquifer where basin boundaries were accurately by tracing and hydraulic head mapping a multiple linear regression of percentage of sinking stream water and chemical (hardness) explained 99.3% of the variation. However that paper is also rather obscurely published in the proceedings of a Swiss karst conference. In any case the simplest test is to look at nine out of ten of the deepest caves in the world and five out of ten of the longest, which all have very low variability springs and by Shuster and White's model would mean that those aquifers should have no conduits! This reviewer has been in many of those caves so would have difficulty being convinced that there are no conduits in those aquifers! More recently Worthington et al., (2002a, 2002b) show that in any unconfined carbonate aquifer regardless of age of rock and matrix porosity, >94% of the flowing water in the aquifer is in conduits despite the fact that the matrix provides most of the storage. Discharge variability of a spring is a function of the elevation of the spring's outlet in comparison to the head and gradient in the bedrock. Springs that cease flowing are only discharging high-stage or overflow components. In each groundwater basin, at low stage one spring is discharging even though at high stage some basins discharge from orders of magnitude more overflow springs (Ray, 1997). The fact that the springs at the Bennett's Dump Site are all of the overflow type means that the ultimate discharge locations of the PCBs during low ground water stage have not been found and will have to be.

Response: The EPA appreciates the commentor's literature review regarding the relationships of spring flow variability and hydrogeologic regime in karst terrain. EPA notes several unique aspects of the referenced springs that set them apart from typical karst springs in the Bloomington area. Mound Spring is located at the downgradient edge of an extensive system of backfilled limestone quarry pits. It's name originates from the fact that it discharges from a large "mound" of quarry rubble used to backfill the quarry pits. The spring appears to occur at a low point on the rim of the buried quarry complex, and the spring flow is most analogous to overflow from a tilted bathtub.

EPA believes that the water discharging from Mound Spring is derived largely from channels in the rubble filled quarry pits rather than dissolution conduits in native limestone bedrock. Groundwater discharging at Mound Spring is unique to other groundwaters in the area in that it contains elevated levels of chloride similar to water in open Quarry pits to the southeast. The chloride is believed to be derived from direct road salt runoff into the open quarry pits. The open quarry pits are in hydrologic connection to the downgradient buried quarry pits that feed Mound Spring.

Hydrologic investigations of Middle Spring suggest that it is a discharge point for groundwater circulating near the soil bedrock interface. As documented by numerous shallow piezometers in the area, the spring issues from a small pool in natural soils approximately 11 feet thick. The spring appears to be fed by upslope areas to the east, which receive overflow from buried quarry pits containing PCBs. The actual spring location appears to be controlled by a gravel-filled abandoned channel of Stout's Creek rather than a dissolution conduit in the native limestone. A pumping test of well, BC-10, was completed in the sand and gravel near Middle Spring. A short term pumping test of this well in November 2005 caused the spring to cease flowing and demonstrated the connection to the gravel layer.

EPA believes that groundwater and PCB discharge to Stout's Creek continues to occur after the on-site springs referenced above cease discharge and that an "underflow" component of groundwater flow does occur. There are at least two lines of evidence that support this. Hydrologic monitoring data for the Bennett's Dump site has shown that water levels in the abandoned quarry pits feeding Mound and Middle Spring continue to decline after flow ceases from the know springs. Further evidence comes from mass-balance studies of PCB discharges to Stout's Creek conducted in 2002 and 2003. Three sets of sample and flow gage data from 2002 indicated that only 15 to 64 percent of the PCBs present in downstream Stout's Creek could be accounted for by discharges from the known springs. A more comprehensive series of samples collected from Stout's Creek and springs in October 2003 again revealed more flow and PCB mass discharge in downstream Stout's Creek than could be accounted for by the known spring discharges. Only about 34 percent of the PCB mass discharge in downstream Stout's Creek could be accounted for by known spring discharge (see Attachment 1 of this Responsiveness Summary). Sampling directly within the channel of Stout's Creek suggests that that the most significant PCB mass influx occurs in the downstream part of the site near monitoring well MW-5A where the former abandoned gravel-filled channel of Stout's Creek intersects the current channel.

Comment 258: The flux of PCBs will be related to suspended solids at the springs so a sampling frequency "tuned" to storm events should be developed. Suspended solids often increase during storm events because velocities are higher and therefore transport of these particles increases. If the mass of PCBs inferred in discharges is less than inferred in the source areas the problems may be related to a lack of samples during storms and the overflow/ underflow problem cited previously.

Quantitative tracer testing using the most conservative injected dyes and careful stream-flow measurements at different stage conditions at downgradient locations could allow a water mass balance to be estimated. Underflows that are not being measured will be revealed as a missing component in the discharge when allowing for reasonable measurement errors. Mass of tracer recovered could support the model also, but only if dyes that are used do not react with the substrate (such as CI AR 388, rhodamine WT, which is known to deaminoalkylate and change from a pink fluorescent compound to a green fluorescent compound. Filter fluorometry alone can mistake the green components for uranine (CI Acid Yellow 73; disodium fluorescein). If tracers cannot be recovered it will be evidence that monitoring locations for them have not yet been found and that the investigation is incomplete.

Response: During storm events, PCB levels in site springs typically remain in the same concentration range as for non-storm events. They do not show the pronounced spike typical of the karst springs at other Bloomington PCB sites.

Mass balance calculations to determine additional PCB sources to Stout's Creek in addition to the know springs have been conducted. See response to Comment --

Comment 259: The site location is not shown or described clearly so that anyone using applications such as Google Earth can easily locate it, for example, no latitude/longitude coordinates are published only rather vague descriptions about the location and figures that do not show enough local features such as major roads.

Response: A number of documents are available in the Administrative Index which describes the location clearly.

Comment 260: To begin, there are four fundamental problems with EPA's proposal: 1) The plan won't work, 2) EPA's description of the plan and the rationale for the plan is dishonest, 3) the plan violates the law, and 4) the plan will leave the public and environment at a continuing great risk of harm.

EPA's "Proposed Plan for the Record of Decision Amendment Operable Units Two and Three Bennett's Dump Superfund Site Bloomington Indiana" (hereafter "proposed plan") does not adequately protect public health and the environment. In order for such a plan to be protective, it would have to provide for the maximum feasible (from an engineering not cost perspective) removal of PCBs and contaminated material from the karst environment in which the PCBs have been disposed. Because of the karst features including sink holes, springs, and underground channels, there is no way to contain toxic contaminants such as PCBs disposed in karst. The karst environment simply provides underground transport routes for contaminated water that cannot be defeated. This is a truth that EPA's own scientists reported to EPA in the first few years of EPA's involvement with the Bennett's site(s) in the 1980s. EPA, motivated primarily by a desire to minimize polluter Westinghouse/CBS' and its own cleanup costs, has spent more than 20 years in denial of this fundamental truth, at the expense of great damage to the health of the public and both migratory and native wildlife.

EPA's proposed plan again makes the same fatal mistake as the EPA's original failed source control "hotspot removal" plan. It proposes to leave substantial amounts of highly toxic PCBs in the ground in a karst environment. But EPA has already proven through its original failed source control hotspot removal plan that this approach simply does not work.

Response: EPA disagrees with the commenter. EPA's desire is not to minimize CBS's cleanup costs. On the contrary, CBS has spent multi-millions of dollars addressing PCBs in Bloomington and we expect CBS to spend additional millions of dollars to remediate the Bloomington PCB sites. EPA has not left substantial amounts of PCBs at the Bennett's Dump site. The area of excavation contained areas which were formerly quarried and filled with rubble, soil and debris. Groundwater was discovered contaminated with PCBs. The low levels of PCBs in groundwater will be captured in a collection trench and treated prior to discharge to Stout's Creek. The comment that "karst cannot be defeated" assumes that you cannot capture contaminated water in karst terrain. By using a collection trench, contaminated groundwater can be captured effectively over time with proper maintenance and monitoring. The commenter also references EPA scientists making the claim that karst cannot be defeated. Since the early 1980s much more information has become available that supports the use of water treatment at the site. The claim that substantial amounts of PCBs remain at the site is not supported by the extensive verification sampling data at the site. The site can be redeveloped to industrial/commercial standards with an average of 11.3 ppm PCBs. Finally, the commenter fails to recognize the nine criteria used to evaluate site remedies as described in the NCP. EPA does agree that excavating low levels of PCBs at depth below the groundwater elevation is the best approach, particularly when groundwater will still require treatment.

Comment 261: EPA admits that it still does not know the quantity of PCBs remaining in the quarry pits and surrounding soil, waste materials and limestone. Had EPA performed a Remedial Investigation and Feasibility Study (RI/FS) or an Environmental Impact Statement (EIS) as required by federal law to define the nature and scope of the contamination and alternatives for cleaning it up, EPA would not be facing the problem it now faces. EPA's decision to proceed once again with a remedial action in the absence of an RI/FS or EIS and public comment thereon violates federal law.

EPA fails to even consider or submit for public comment the obviously most protective and compliant alternative. This alternative would involve the following common sense approach: 1) prepare an adequate RI/FS to identify the location of the remaining PCBs and the location of the base groundwater flow as well as all overflow springs, 2) excavate all of those PCBs to the extent feasible from an engineering perspective (not based on cost) using an enclosure with air filtration to prevent PCB air releases, 3) then perform a water flow and PCB release study, and 4) then design and implement one or more interceptor trenches and water treatment systems, again within an enclosure having air filtration to prevent PCB air releases, as required to capture and treat any remaining PCB discharges including in the base flow. One can only presume this is because CBS (formerly VIACOM formerly Westinghouse) has refused to pay for such an imminently reasonable (but more expensive) approach.

Response: The commenter is incorrect. At the time the original remedy was selected it an RI/FS was not required prior to remedy selection. To support the original remedy for Bennett's Dump, however, a large amount of data was collected, and this served as an RI/FS equivalent. Since the selection of the original Bennett's Dump remedy the Superfund Law was changed, as was the National Contingency Plan. Now, for new sites where no remedy has yet been selected, an RI/FS ordinarily would be required. However, for sites, like Bennett's, where a remedy has already been selected (here through an enforcement decision document and memorialized in a consent decree), even where an RI/FS has not previously been prepared, it is not necessary to start over with an RI/FS to support a change to the original remedy. Instead, U.S. EPA follows it's ROD amendment process, as it has done here, to develop data and other information that supports changes to a selected remedy.

In this case to support changes to the original Bennett's Dump remedy, a number of investigations were completed to characterize the Bennett's Dump site. The nature and extent of contamination was determined and a large investigation on the site hydrology was completed. A human health and ecological risk assessments were completed. Alternatives to remediate the site were evaluated and the subsequent Proposed Plan was issued for public comment. EPA did excavate PCBs based upon the nine criteria and air monitoring was completed during the excavation activities. The air monitoring did not show that PCBs were causing an unacceptable risk to workers or nearby homes. The preferred remedy does call for the design and implementation of interceptor trenches.

Comment 262: EPA predicts that PCB releases will be "reduced" by its proposed action but does not present data that justifies that prediction (in its public comment documents or in its administrative record or the public document repositories) or that allows the amount of reduction in current PCB releases from its proposal to be quantified. This is a critical point because even using EPA's own chosen risk assessment methods (which have the convenient advantage of ignoring the existing PCB and Dioxin overexposure for infants, children and adults), the risk to both humans and wildlife from the current PCB releases from the Bennett's site were found unacceptable by EPA many times over, as EPA reports in its public comment document. The PCB release reduction achieved by EPA's proposed plan for Bennett's Dump would have to be at least 95% to bring EPA's own risk calculations into a range that EPA itself would consider "acceptable."

However, even then, to find the remaining 5% PCB release to be "acceptable one would be forced to ignore EPA's risk policy which dictates either that existing exposures to the target compound be considered in the risk assessment if these exposures are known (which is the case for PCBs and Dioxin), or the conservative assumption be made that at least 75% of one's total exposure to the target compound will come from other sources (which requires that the hazard quotient acceptable risk standard not be 1.0 as EPA states in its Bennett's documents but rather 0.25). Either way, the remaining 5% PCB release would still result in an unacceptable risk given the calculations EPA presents in its Bennett's Dump public comment documents.

Response: PCB releases will be reduced with the implementation of Alternative 5 and, over time, the PCB concentrations in fish will decrease. EPA is unsure how the commenter has calculated the 95% risk reduction. EPA has completed both a human health and ecological risk assessments using EPA approved guidance. EPA did evaluate exposures to PCBs and dioxin-like PCBs in its risk assessments and additional information on addressing background concentrations is discussed in the Response to Comment 265. The commenter's statement regarding the use of 75% of one's total exposure to the target compound coming from other sources is not part of EPA's Superfund risk assessment guidance and a Hazard Quotient of 1 continues to be EPA's point of departure. As noted in the Bennett's Dump Proposed Plan, revised total hazards are less than 1 at all locations. The remedy to be implemented will address the releases and over time, PCB concentrations in fish will decrease.

Comment 263: EPA appears oblivious to the fact that, given that the current U.S. population has PCB and Dioxin exposures that exceed the RfD and MRL for most members of the population of all ages, and all breast fed (and likely bottle fed) infants, and the population's exposure ranges past not only the hoped to be conservative RfD and MRL estimate of the real point at which harm occurs but ranges over as well PCB and Dioxin exposure levels at which animal studies have actually shown harm, that there is no way to rationalize an on-going release of PCBs or Dioxin as "safe." A release of these highly toxic persistent world traveling compounds will eventually result in the exposure of persons (and animals) whose existing exposure has already put them on the edge of the danger level, causing harm that otherwise would not have occurred because for those individuals (and animals) the threshold for harm would not otherwise have been crossed.

The long and short of this analysis is that EPA must take every possible step to prevent further release of PCBs and related compounds at Bennett's Dump and the other Bloomington sites, and EPA's current proposed plan simply does not do so. EPA should reject all five of the alternatives it has presented to the public and proceed expeditiously to select and implement the "omitted" common sense alternative identified and described above.

Response: Please see the Response to Comment 265 for a discussion of dioxin exposure. EPA has chosen a remedy that will prevent the further release of PCBs and related compounds. The EPA's approach has been similar to the approach described in Comment 261 in which the commenter suggests the use of interceptor trenches for groundwater.

Comment 264: Whatever approach EPA proceeds to follow, it needs to do so with a significantly greater degree of openness and honesty than it has demonstrated in proposing the Bennett's Dump plan under review. EPA can start by informing the public unqualifiedly that the original "operable unit 1" source control remedy has failed because it did not effectively remove or control the original source of PCB contamination at Bennett's Dump. EPA has admitted, reluctantly and between the lines, in its public comment documents for the proposed plan for Bennett's Dump "operable units two and three," that substantial amounts of PCBs remain at the Bennett's site and these PCBs continue to contaminate water and be released. This water being contaminated was not contaminated at the time of EPA's implementation of its waste removal effort in the operable unit 1 source control remedy. This means simply that EPA's first PCB source control plan failed and a significant PCB source remains at the site uncontrolled.

EPA should, but has not admitted this. This failure of the first operable unit as a source control strategy is reflected in the design of the purported new proposed operable unit two, which EPA avoids calling source control but calls a water treatment operable unit instead. It is apparent that the new proposed operable unit two is in fact designed to address previously uncontaminated water that continues to become contaminated by flowing into contact with a remaining uncontrolled PCB "source" at the Bennett's site. This is the whole purpose of the plan component that involves draining the quarries that are thought to be feeding (relatively) uncontaminated water into the Bennett's site where the water becomes PCB contaminated and then is discharged to Stout's Creek. Because the new proposed "water treatment" plan is not really designed to address some body of pre-existing contaminated water (water contaminated by the PCB source since removed in operable unit 1) but is designed to address previously uncontaminated water that continues to become contaminated by a PCB source that has not been removed or controlled, it in reality is a follow-on second attempt at PCB source control because the first attempt failed. The proposed operable unit two attempts to control the still existing PCB source by reducing or eliminating the flow of uncontaminated water into the PCB source, and then treating the water that still manages to contact that PCB source. EPA should be honest about this with the public and not continue to represent that the first source control operable unit was successful.

Response: EPA has been open and honest with the public. EPA disagrees with the commenter that the first operable unit failed. The excavation was not a hot spot removal as described by the commenter but an excavation which remediated the site for commercial/industrial development. Substantial amounts of PCBs do not remain on the site as the commenter stated. The groundwater has been contaminated for many years and has been releasing to Stout's Creek but the buried quarry pits were unknown at the time of the 1999 excavation and this did affect the source control cleanup. The depth of the buried quarries and low levels of PCB contamination at the site does not make it practical to excavate additional material. The contaminated groundwater will be captured and treated to address the PCB releases.

Comment 265: As a second step towards being open and honest with the public that EPA is obligated by law to serve and protect, EPA should accurately report to the public the scientific facts regarding: 1) the mass of PCBs that have been released over time from the Bennett's Dump and other Bloomington sites not only via water discharges but also via releases to air, 2) the extent to which PCBs released to air are captured via a number of processes by plants and thereby enter the food web, and 3) the extent to which Bloomington and U.S. residents, including infants, are already exposed to PCBs, Dioxin and related compounds through food, water and air. EPA should likewise openly disclose how these existing exposures compare to ATSDR's MRL and EPA's Office of Water's RfD for dioxin and dioxin-like compounds, and to animal studies showing adverse effects. EPA should also fully report to the community the implications of the new studies regarding epigenetic effects of endocrine disrupting chemicals.

Response: EPA believes it is not practical (and would be of questionable valuable) to determine PCB mass releases to the air and water. The focus has been to address the unacceptable risk at the site through the implementation of source control and water treatment. To calculate the mass released would require a number of assumptions which would make the results questionable and inaccurate.

At every opportunity, EPA has provided extensive information to the public regarding dominant human exposure routes and risks regarding PCBs in Bloomington. EPA provided risk analyses regarding consumption of garden vegetables grown in soils contaminated with PCBs and implemented appropriate soil cleanup levels to protect public health. Short term releases of PCBs to the air do occur during cleanup operations and EPA has collected air samples and conducted risk assessments showing no significant risks to the public.

EPA believes it is impractical to conduct a theoretical modeling exercise on the amount of PCBs previously released to the air from area landfills. Such an analysis is subject to great uncertainty and it is extremely difficult to translate such evaluations into levels present on local vegetation. Historical air releases of PCBs, a small fraction of that released to the water, would have occurred but it improbable that amounts deposited from the air onto local vegetation and into the food chain would give rise to exposure levels measurably higher than those already occurring due to background air deposition resulting from global PCB use and dispersion. It should be recognized that the removal of thousands of tons of PCB wastes from the Bloomington area will reduce PCB releases to the air and address risk pathways which are more important to protect public health and wildlife.

PCB contamination of local vegetation and resultant risks of human exposure are orders of magnitude of less concern than are exposures which may occur from (1) fish consumption (2) direct ingestion of soils contaminated by capacitors, sludges and other wastes or (3) growing of garden vegetables in soils contaminated by wastes. EPA has made clear that the highest risks come from the consumption of fish and as a result has taken action to reduce PCB levels in wastewater discharges. Tests on drinking waters show no PCBs.

EPA has discussed the issue of background risks from exposures to PCBs, dioxins, and dibenzofurans which primarily occur due to the consumption of fatty foods (etc., beef, dairy). This is a global exposure issue. People can reduce exposures to PCBs present in certain commercially available foods by following a low-fat diet which has other health benefits. EPA's Office of Solid Waste and Emergency Response (OSWER) has not as yet made policy determinations regarding background exposures to PCBs and dioxin. The background exposure issue cuts both ways. If background exposures resulting from a particular chemical in the food supply is higher than those from exposure caused by a waste site, then it might be decided that there is no real value in addressing an environmental contamination problem.

Current background exposures, for people around the world exposed to dioxins and dibenzofurans, are in the range of 1-2 pg/kg-bw-day and have been declining over the past two decades. At background exposure levels there is some evidence of adverse health effects in the general population, including type II diabetes, endometriosis, and other endocrine effects. ADSDR's MRL and EPA's RfD have established at 1 pg/kg-bw-day. U.S. EPA is currently awaiting the National Academy's evaluation of EPA's dioxin reassessment to revise various health criteria.

Comment 266: As another step towards honesty, EPA can stop calling "doing nothing" an "operable unit" as they do with operable unit 3 for contaminated sediment at the Bennett's site. EPA should also consistently report risks to both humans and wildlife for each component of its proposed actions. EPA appears to ignore wildlife in discussing risks from its no action plan for sediments, although EPA made a point of discussing the considerable risks to wildlife when such risks supported selection of a "do something" alternative regarding water, where EPA had chosen to do "something."

Response: EPA evaluated sediment in the human health and ecological risk assessment. EPA did not ignore wildlife in its analysis in the ecological risk assessment. The sampling data showed concentrations under 1 ppm PCBs, along with the existence of a rocky bottom (that is, low sediment volume present) within Stout's Creek, lead EPA to propose No Action for operable unit 3.

Comment 267: We look forward to the day when our federal and State environmental agencies stop looking for ways to rationalize allowing toxic releases to the environment to continue in order to save the polluting corporations money (at the expense of public health) and start requiring the polluting corporations to pay for decisive actions that stop the toxic releases these corporations caused by their very profitable but very reckless business practices. We hope that day comes with EPA's final decision on its new remedy for Bennett's Dump.

Response: EPA did not rationalize allowing toxic releases to the environment. EPA decision making was based upon the large number of investigations which have taken place at the Bennett's Dump site and its human health and ecological risk assessment. The construction of the passive quarry drains and interceptor trench with treatment of water will prevent the release of PCBs into Stout's Creek at a concentration and mass that threatens human health and the environment.

Comment 268: White suckers are overrepresented in the modeled diets of mink and kingfish. "EPA relies on data concerning PCB exposures to chicken and pheasants for its calculations concerning exposure to kingfishers" but "recent scientific evidence ... shows that kingfishers are much less sensitive to PCBs than chickens or pheasants".

Response: The contribution of white suckers to modeled diets is addressed under Comment 278.

Toxicological studies of chicken or pheasant exposed to PCBs have no role in modeling exposure of kingfishers to PCBs at the site, but are used *in part* to assess the potential risks associated with the modeled exposures. PCB toxicological studies have not been performed with kingfisher. Uncertainty over the sensitivity of kingfisher is addressed by assessing potential risks with multiple sets of toxicity values to represent a range of sensitivities to PCBs. In addition to studies with chicken or pheasant, studies of PCB effects in doves are also used to assess potential risk to kingfisher. Doves are not considered highly sensitive to PCBs.

The comment that kingfisher has been shown to be insensitive to PCBs is addressed under Specific Comment 275.

Comment 269: Stout's Creek headwaters area "is currently being developed and will undergo substantial additional development over the next five to ten years", which will "limit the availability of suitable and desirable habitat near the Site for ecological receptors".

Response: See Specific Comment 277.

Comment 270: "[T]he portion of Stout's Creek affected is so small that very few ecological receptors will be impacted." In the worse case, only 1 mink or kingfisher "could be affected by PCBs in fish at this portion of Stout's Creek." "According to EPA's guidance, the focus of ecological risk assessment is to protect the population of a species, not individual animals. *See* U.S. EPA OSWER Directive 9285.7-28 "Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites" (October 7, 1999)."

Response: There are two parts to the response. First, the OSWER directive refers to local populations at or near the site, not regional populations. According to OSWER Directive 9285.7-28 P:

> "The goal of the Superfund program is to select a response action that will result in the recovery and/or maintenance of healthy *local* populations/communities of ecological receptors that *are or should be present at or near the site. ...* Contaminated media that are expected to constrain the ability of *local* populations and/or communities of plants and animals to recover and *maintain themselves in a healthy state at or near the site* (e.g., contamination that significantly reduces diversity, increases mortality, or diminishes reproductive capacity) should be remediated to acceptable levels." [emphases added].

Second, mink and kingfisher are selected as assessment endpoints to ensure protectiveness for many other species that are part of the same ecosystem. As discussed in the Problem Formulation section of the Bennett's Dump FERA, one of the reasons for assessing risk to mink and kingfisher is because protection of piscivorous wildlife from PCB-related risks is expected to be protective of fish and other aquatic organisms. The same rationale is used in setting the PCB federal ambient water quality criteria for environmental effects. Therefore, populations of fish may be at risk of adverse effects in the stream reaches in which mink and kingfisher are potentially at risk. Although the number of mink or kingfisher potentially utilizing the affected portions of Stout's Creek at any one time may be small, the numbers of fish and other aquatic organisms in the same reaches are potentially large.

Comment 271: Selection of any remedy other than Alternatives 1 or 2 is not justified by either human or ecological risks."

Response: CBS's assessment of low risk to ecological receptors is based on non-conservative (low) estimates of exposure and non-conservative toxicity reference values (low estimates of toxicity), coupled with dismissal of any unacceptable risk estimates to mink or kingfisher based on a questionable assumption that development will reliably prevent foraging in contaminated reaches by mink or kingfisher. The multiple non-conservative assumptions are contrary to Superfund guidance and practice. Also, CBS ignores potential risks to other aquatic receptors (fish, amphibians, aquatic invertebrates) which were not directly evaluated in the FERA because actions to protect mink or kingfisher from unacceptable risk are expected to be protective for aquatic receptors. If potential risks to mink or kingfisher are disregarded, as recommended by CBS, the possible risks to fish, amphibians, and aquatic invertebrates in the affected reaches are left unknown. Evaluation of risk to mink and kingfisher serves as a surrogate for risk to other aquatic receptors only when remedial actions are taken to reduce unacceptable risks to mink or kingfisher. Evaluation of risk to mink and kingfisher is not protective for other aquatic receptors if findings of unacceptable risk to mink or kingfisher are peremptorily dismissed.

Comment 272: The methods used to derive some of the Toxic Reference Values ("TRVs") for both mink and birds are novel and their utility and accuracy have not been established." "Extrapolation of NOAELs and LOAELs from the combined data sets have several obvious limitations, including comparability of methods between studies." Mink TRV adjustment to account for two breeding seasons' exposure may not be scientifically valid. The uncertainty section should address "this new process and should contrast it with TRVs that would be appropriate from the more typical EPA process based on single high quality studies".

Response: Eight sets of TRVs are used in the FERA, the comments pertain to 2 of these 8 sets. The TRVs in question are based on meta-analysis of multiple toxicity studies, a procedure used to derive mink dietary no effect (500 μg total PCB/kg diet) and low effect (600 μg/kg) TRVs, and kingbird ingestion dose no effect (400 μg total PCB/kg$_{BW}$-d) and low effect (500 μg/kg$_{BW}$-d) TRVs (a second set of kingbird PCB ingestion TRVs used in the FERA are not based on meta-analysis). The remaining 5 sets of TRVs in the FERA are derived through other approaches.

The methods used for the meta-analysis are not novel. The approach is based on Leonards, et al. (1995), who used meta-analysis to interpolate mink tissue-based PCB TRVs on a dioxin-equivalent (TEQ) basis. The method used in the FERA for normalizing data from multiple studies to combine them into a single meta-analysis is the same as used by Leonards, et al. (1995). Other examples of the same normalization approach for meta-analysis of ecotoxicological studies include Isnard, et al. (2001), Tanaka and Nakanishi (2001), and Calabrese (2005). The main differences between the methods in the FERA and Leonard, et al. (1995) are minor ones made for site-specific objectives. The FERA meta-analysis TRVs are derived for PCBs on an individual Aroclor basis, instead of TEQs; exposure to mink is quantified on a dietary basis, instead of tissue accumulation; a different regression method is used (adapted from USEPA guidance on effluent toxicity testing); and, consistent with Superfund practice, TRVs are based on the range between no adverse effects and the onset of adverse effects, while the Leonards, et al. (1995) TRVs are based on a high incidence of adverse effects (affecting 50 % of exposed mink).

CBS incorrectly states that the TRVs are extrapolated, but the meta-analytical method in the FERA is restricted solely to interpolation within the combined data sets, and extrapolation beyond the bounds of the empirical data is not allowed.

Incompatibilities between studies because of differences in study design or other factors are potentially important limitations of meta-analysis and, therefore, are evaluated as part of the meta-analysis performed for the FERA. Significant incompatibilities between studies are revealed by inconsistencies in the exposure-response plots of the combined data sets. There are no inconsistencies among the 3 studies performed by two sets of investigators combined in the meta-analysis of PCB effects on hatchability, to the contrary, the results of the various studies are remarkably consistent with each other (Figure 1). The mink PCB TRVs are based on 4 studies performed by three sets of investigators (two separate experiments reported in Aulerich and Ringer 1977 are included in Figure 2). The results are internally consistent except for an inconsistency between studies at 1 mg/kg PCB dietary concentration (Figure 2). For the FERA, the two data points are averaged before calculating the TRVs, but, if the data point showing greater toxicity at 1 mg/kg PCB is excluded (Aulerich and Ringer 1977), and the TRVs are calculated with only the Wren, et al. (1987) data point to represent the response at 1 mg/kg PCB (showing less toxicity), the TRVs increase by no more than 15 %. Therefore, the difference between studies at this dietary concentration has only a minor influence on the calculated TRVs. Mink reproduction is consistently suppressed in treatments at or above 2 mg/kg dietary concentrations.

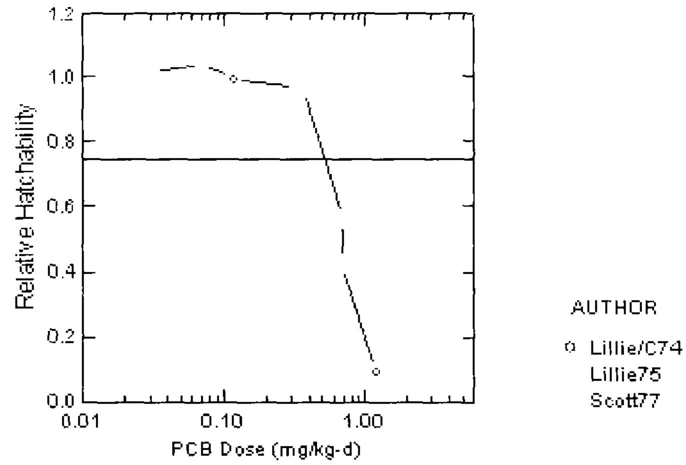


Figure 1. Hatchability, Aroclor 1248 Dose to Chicken Hens
(Lillie/C74 - Lillie, et al. 1974 and Cecil, et al. 1974 (reporting the same study); Lillie75 - Lillie, et al. 1975; Scott77 - Scott 1977)

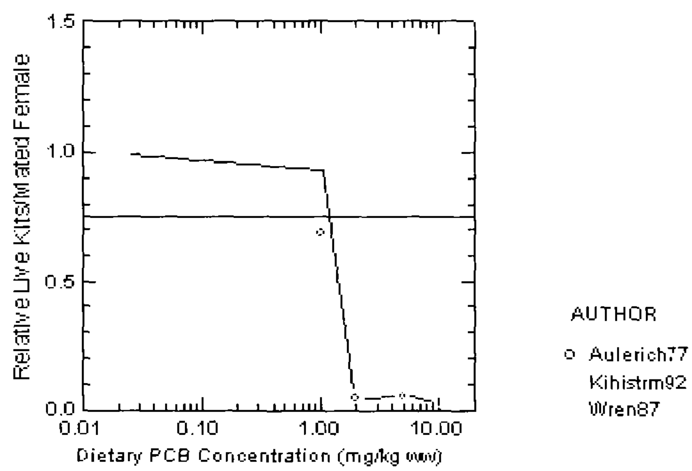


Figure 2. Live Kits per Mated Female Mink Exposed to Aroclor 1254 for 1 Breeding Season
(Aulerich77 - Aulerich and Ringer 1977; Kihistrm92 - Kihiström, et al. 1992; Wren87 - Wren, et al. 1987)

The mink PCB TRVs in the FERA are based on mink feeding studies performed over a single breeding season (longer duration Aroclor feeding studies with mink were not located). Prolonged mink feeding studies with field-contaminated fish (Restum, et al. 1998) or with a European PCB product (Brunström, et al. 2001) have shown increased toxicity after continuous exposure through 2 breeding seasons or to 2 generations of mink. The TRVs based on single-breeding season exposure to Aroclor 1254 are accordingly adjusted to reflect the increased toxicity with longer exposure as seen in other mink studies. The findings of increased PCB toxicity with prolonged exposure over more than one breeding season or generation in two mink feeding studies are supported by similar findings in PCB studies with other mammals:

McCoy, et al. (1995) reported the PCB body burden in oldfield mice (*Peromyscus polionotus*) approximately doubled between generations at a constant exposure concentration, and was associated with increasingly adverse effects.

> "These observations indicate that, even at this low level, chronic exposure to PCBs has pronounced reproductive effects on mammals and that these effects are amplified through multigeneration exposure. ... It is apparent that continued exposure at a low level results in amplified body burdens over three generations. For wild populations that remain in the same area for many generations, cumulative effects may have serious consequences. ... In studies of wild populations, it is evident that the roles of maternal exposure and increasing body burdens must be considered in assessing the long term effects of PCB exposure."

Linzey (1988) reported for white-footed mice (*Peromyscus leucopus*) that

> "Reproductive success of second generation PCBs-treated white-footed mice was reduced in comparison with performance of the parental generation reported by Linzey (1987). ... These results confirm the expectation that effects of chronic exposure to PCBs are cumulative through generations, probably due to length of exposure as well as to exposure during critical periods of growth and development."

The PCB studies are consistent with an increase in the reproductive toxicity of dioxin (TCDD) associated with exposure to multiple generations of rats compared to exposure to a single generation (f_0 is the initial generation tested, f_1 is the offspring from f_0, and f_2 is the offspring from f_1) (Murray, et al. 1979).

> "At the intermediate dose of 0.01 μg TCDD/kg/day, many adverse effects seen in the f_1 and f_2 adults and their litters were not evident in the f_0 adults or their offspring. The most obvious difference is that the f_0 rats were given TCDD beginning at about 7 weeks of age whereas subsequent generations were exposed to TCDD, at least theoretically, from the time of conception. This suggests that some of the effects observed were initiated, perhaps, during the neonatal period."

Following a suggestion of CBS (then Viacom), an uncertainty analysis has been performed for the two sets of meta-analysis TRVs. The procedure, recommended by Dr. John Giesy, ENTRIX, consultant to CBS, is to remove data points individually from the combined data set to assess the effect of incompatibilities between studies and treatments on the TRV interpolation. The results show that the TRVs for PCB dietary exposure to mink, and PCB ingestion dose to birds, are robust to data variability in the upper range of exposures, but not in the lower range of exposures. In other words, the "actual" TRVs are unlikely to be higher than the values used in the FERA–the analysis recommended by

CBS resulted in no more than a 20 % increase in the calculated TRVs, and mostly less than 10 % changes related to variability in the upper range of exposures, but the "actual" TRVs might be lower than derived for the FERA–the procedure resulted in 35 to 90 % decreases in calculated TRVs related to variability in the lower range of exposures. This implies that risk calculations based on these TRVs are unlikely to overestimate risk, but the possibility that risk might be underestimated cannot be ruled out.

TRVs derived through what CBS characterizes as a "more typical EPA process based on single high quality studies" are presented in Appendix E of the FERA, and comparisons with the TRVs used in the FERA are discussed in FERA Sections 4.1 and 4.2. The discussion is expanded below:

Two high-profile applications of mink total PCB TRVs in USEPA Region 5 have been for the Great Lakes Initiative (GLI) and the Fox River Superfund site in Wisconsin. The TRVs were based on "single high quality studies", and were externally peer reviewed in both cases. Converted to a dietary basis, the Fox River mink LOAEC (0.5 to 0.7 mg PCB/kg diet) is highly consistent with the LOAEC of 0.6 mg PCB/kg diet in the FERA. The NOAEC for the Fox River (0.25 mg PCB/kg diet), is lower (more conservative) than the FERA NOAEC of 0.5 mg PCB/kg diet. The LOAEC for the GLI (2.0 mg PCB/kg diet) is higher than the FERA LOAEC, but is based on complete reproductive suppression in mink, which is inadequately protective for regulatory purposes (the GLI water quality criteria are based solely on no effect levels, and the LOAEC served only as a starting point for estimating a NOAEC). Again, the GLI NOAEC (0.2 mg PCB/kg diet) is more conservative than the FERA NOAEC. The low NOAEC values chosen for the Fox River and GLI are the result of wide dose spacing in individual experiments that missed the actual dose at which adverse effects begin to be observed. By combining multiple studies, the meta-analysis in the FERA provides a more detailed characterization of the relationship between exposure and reproductive effects compared to single-study approaches.

Outside of USEPA Region 5, the externally peer-reviewed mink TRVs for the Hudson River are much more conservative (LOAEC – 0.25 and NOAEC – 0.025 mg PCB/kg diet) than the mink TRVs in the FERA. A site-specific mink feeding study was performed for the Housatonic River Superfund site (Bursian, et al. 2006). The dietary concentration of the treatment resulting in decreased kit survival (3.7 mg PCB/kg diet) is higher than the LOAEC TRVs used at other Superfund sites, but resulted in high kit mortality (54 %). The investigators performed probit regression analysis to calculate the dietary concentrations lethal to 20 % and 10 % of kits (LC_{20} and LC_{10}, respectively) and the associated 95 % confidence intervals (CI). The LC_{20} is 1 mg PCB/kg diet (CI: 0.5 – 1.9 mg/kg), and the LC_{10} is 0.2 mg PCB/kg diet (CI: 0.03 – 0.5 mg/kg) (rounded values based on Bursian, et al. 2006). The Bursian, et al. (2006) LC_{20} differs from the FERA LOAEC by less than a factor of 2, reasonably consistent with the observed difference in toxicity between PCB exposure over 1 breeding season versus exposure over 2 breeding seasons. In contrast, the Bursian, et al. (2006) LC_{10} is lower (more conservative) than the FERA NOAEC. However, the 95 % confidence intervals for the Bursian, et al. (2006) LC_{20} and LC_{10} include the values of the LOAEC (0.6 mg PCB/kg diet) and NOAEC (0.5

mg/kg) TRVs, respectively, used in the FERA. The Housatonic River studies are discussed further in the response to Specific Comment 3.

Overall, the FERA mink PCB NOAEC is less conservative than the NOAECs based on "single high quality studies" at other sites. The estimated risk to mink would be much higher if the FERA NOAEC TRV were replaced with the externally peer-reviewed NOAEC TRVs for the Fox River Superfund site, the Hudson River Superfund site, or the Great Lakes Initiative, or with the LC_{10} of the Housatonic River study.

Overall, the FERA mink PCB LOAEC is a median value among the LOAECs based on "single high quality studies" at other sites. The estimated risk to mink would increase more than 2-fold if the FERA LOAEC TRV were replaced with the externally peer-reviewed LOAEC TRV from the Hudson River site, the risk estimate would not change if the externally peer-reviewed Fox River LOAEC TRV were used, and about 40 % less risk would be estimated based on the LC_{20} of the Housatonic River study with no adjustment for exposure duration.

Two high-profile applications of avian total PCB TRVs in USEPA Region 5 have been for the Great Lakes Initiative (GLI) and the Fox River Superfund site in Wisconsin. The TRVs were externally peer reviewed in both cases. The GLI LOAEL (0.6 mg PCB/kg_{BW}-d), based on a study with pheasant, is similar to the FERA LOAEL (0.5 mg/kg_{BW}-d), but the GLI NOAEL (0.2 mg/kg_{BW}-d) is lower (more conservative) than the FERA NOAEL (0.4 mg/kg_{BW}-d). The Fox River LOAEL (1.12 mg/kg_{BW}-d), based on effects in doves, is higher than the FERA LOAEL, but the Fox River NOAEL (0.11 mg/kg_{BW}-d) is much lower than the FERA NOAEL. The Fox River avian TRVs are incorporated into the FERA in addition to the meta-analysis TRVs to provide a range of risk estimates for kingfisher to account for unknown sensitivity to PCBs.

The TRVs for kingfisher at the Hudson River Superfund site (LOAEL – 7.1 and NOAEL – 1.8 mg PCB/kg_{BW}-d) are much higher than the TRVs for the FERA, Fox River, or GLI. The Hudson River TRVs are based on the same pheasant study used by the GLI, but a different and less sensitive endpoint was used for the Hudson River (egg production) than for the GLI (egg hatchability). Use of egg production for setting PCB TRVs is questionable for two reasons: first, egg production in chicken, a sensitive species to PCBs, shows no coherent relationship with PCB exposure (Figure 3), and second, there is "very little evidence" that egg production limits clutch size in the field (Mineau 2005). The GLI use of egg hatchability, not egg production, is a more ecologically relevant basis for deriving TRVs.

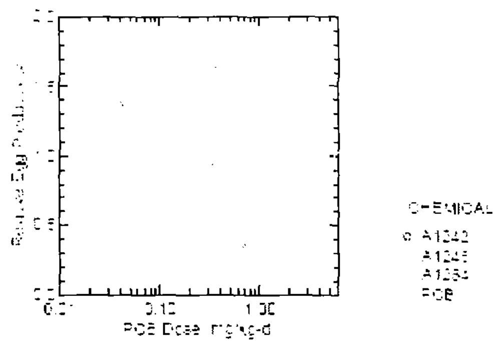


Figure 3. Egg Productivity, PCB Dose to Chicken Hens
(Sources: Britton and Huston 1973; Cecil, et al. 1974; Lillie, et al. 1974; Platanow and Reinhart 1973; Scott 1977; and Summer, et al. 1996a,b)

Comment 273: Housatonic River mink study "is the highest quality, most relevant study from which TRVs can be derived". "[I]t has been established that dioxin toxic equivalents ("TEQs") are the most accurate predictor of toxicity to mink." The relative potencies of dioxin-like activity are similar in Housatonic River and Stout's Creek fish. USEPA used NOAEL TRV for GBH in the Hudson River ERA based on Halbrook et al. (1999) field study where Aroclor 1260 was the contaminant. "If the EPA considered the TRVs derived from the Housatonic study, the calculated hazard quotients would be shown to be much smaller."

Response: The mink feeding study performed for the Housatonic River Superfund site is a high quality single-breeding season exposure study, but the applicability to the Bennett's Dump site is uncertain because of the differences in the major Aroclors released at each site. The predominant Aroclor released to the Housatonic River was Aroclor 1260 (USACE/USEPA 2004), reflected in both Housatonic River aquatic biota (Yanik, et al. 2003) and tree swallows (Custer and Read 2006).

Aroclor 1260 differs in composition and toxicity from Aroclor 1242, the predominant Aroclor disposed in Bennett's Dump. The dioxin-like toxicity of Aroclor 1260 is less than one-half of that of Aroclor 1242, as shown by bioassays that provide an integrated measure of total dioxin-like activity (Tillitt, et al. 1992). Aroclor 1260 differs in having a larger polychlorinated dibenzofuran (PCDF) co-contaminant component compared to other Aroclors—12 times as much as Aroclor 1242 (Wakimoto, et al. 1988). Most of the TEQ of Aroclor 1260 is due to PCDFs (70 %), not PCB coplanar congeners (29 %), in contrast to Aroclors 1248 and 1254 in which most of the TEQs are due to PCB coplanar congeners (at least 90 %) with only small PCDF contributions (less than 10 %) (Yamashita, et al. 2000). The predominant role of PCDFs in causing toxicity at the Housatonic River site is supported by a field study of tree swallows:

> "The hypothesis that the dioxin and furan congeners are contributing to reduced hatching success *more so* than the PCB congeners is further supported by the two-variable model results. In these models, TEQs associated with PCBs become nonsignificant in both analyses, while the WHO TEQs for dioxin/furans remained as a significant variable ..." (Custer, et al. 2003) [emphasis added].

PCDFs also bioaccumulate less overall compared to PCB coplanar congeners. The reported biota-sediment accumulations factors (BSAFs) in field studies are lower for PCDFs than for PCBs (Niimi 1996; van der Oost, et al. 1996; Marvin, et al. 2002; Naito, et al. 2003; Burkhard, et al. 2004). Similarly, diet-to-egg biomagnification factors (BMFs) for birds are lower overall for PCDFs compared to PCB coplanar congeners (Hoffman, et al. 1996; Henny, et al. 2003; Murata, et al. 2003).

Despite the differences in composition and bioaccumulation between the predominant Aroclors released at the sites, the ratios of TEQ to total PCBs in fish samples appear to be similar for fish from the Housatonic River and Stout's Creek. However, total PCBs are measured differently at the two locations: sum of PCB congeners for Housatonic River fish and total Aroclor for Stout's Creek fish. Aroclor analysis may overestimate or underestimate total PCBs compared to the sum of congeners (Sather, et al. 2003; Connor, et al. 2005). For Stout's Creek fish, the magnitude of the difference between Aroclor-based and congener-based analysis of total PCBs is unknown, so there is significant uncertainty over the comparison with the data on Housatonic River fish. TEQ is also measured differently at the two sites, for Stout's Creek samples it includes only dioxin-like PCB congeners, but for the Housatonic River Samples, TEQ also includes the contributions of dioxins and chlorinated dibenzofurans.

The statement that "If the EPA considered the TRVs derived from the Housatonic study, the calculated hazard quotients would be shown to be much smaller" is inaccurate. As discussed in the response to Specific Comment 2, the LC_{10} of the Housatonic River mink study is lower (indicates *more* toxicity) than the FERA NOAEC. The Housatonic River LC_{20} is somewhat higher than the FERA LOAEC (indicates about 40 % less toxicity), but the 95 % confidence interval for the LC_{20} includes the value of the FERA LOAEC, and the difference between the values is consistent with the observed increase in PCB toxicity with exposure over more than one breeding season.

Comment 274: FERA TRVs for kingfisher "are all from other bird species". "Gallinaceous birds, such as chicken and pheasants are among the most sensitive birds" to PCBs. EPA should base the kingfisher TRV on Housatonic field study (Henning and Brooks 2003). "[I]t has been established that the TEQs are the most accurate predictor of toxicity to fish eating birds." The TEQs of Housatonic fish (mg TEQ/kg PCB) are similar to Bennett's Dump fish. "There is a growing body of evidence that suggests that it is inappropriate to apply chicken based TRVs to piscivorous birds for TEQs." "[T]he raptor TEQ egg LOAEL ranges conservatively from 210 pg/g to 303 pg/g based on enzyme induction ... [which] occurs at much lower concentrations than effects on reproduction and development."

Response: Chicken are known to be sensitive to PCBs, and chicken PCB toxicity data are used to derive one set of TRVs to represent higher sensitivity to PCBs, but a second set of TRVs based on doves is also used in the FERA to represent middle sensitivity to PCBs, which brackets uncertainty over the sensitivity of kingfisher to PCBs. It would be inappropriate to solely assess potential risk to kingfisher based only on TRVs for insensitive species when the sensitivity of kingfisher is not known.

Data from a dioxin study with pheasant is used for dose-based TEQ TRVs. Although pheasant are also a gallinaceous species, pheasant is less sensitive to dioxin than chicken. One of CBS's consultants described pheasant as "one of the more tolerant species" to dioxin-like effects (Giesy, et al. 1995; see also Bowerman, et al. 1995).

The kingfisher field study performed at the Housatonic River site is limited by several shortcomings in design, including an insufficiently broad exposure gradient, lack of a control or reference population, and a method of evaluation that is subject to confounding because the results of the field study are compared to that of a single study from the literature for a different location. According to the Housatonic River ERA (USACE/USEPA 2003 §8.5.4):

> "The belted kingfisher field study results do not definitively support the conclusions of low risk because the data are limited. There are several conclusions drawn by the authors that are not strongly supported by the information presented in the report. The conclusion that the kingfisher population is consistent with the quality of habitat present is speculative. ... It is inappropriate to conclude that the Housatonic River kingfishers fall within the range reported for other kingfisher populations when only one study is referenced."
>
> "... EPA was not provided with an opportunity to review these protocols prior to receiving the study. There were several shortcomings of the approach used. For example, there was no reference site, no information was provided regarding nest search intensity, the researchers were unable to determine clutch size, and there were too few visits to the nests during the reproductive cycle. These shortcomings limit the ability to draw rigorous conclusions."
>
> "The approach used to estimate dose in the belted kingfisher study had a number of shortcomings. ... As a result, the dose gradient achieved by this approach is likely too narrow to detect a significant dose-response relationship."
>
> "The sample sizes were very small (i.e., n=6) for the statistics used ..."

For these reasons, the Housatonic kingfisher field study is not considered an adequate study for reducing uncertainty over the relative sensitivity of kingfisher to PCBs. Other issues concerning the applicability of Housatonic River studies to the Bennett's Dump site are discussed under Specific Comments 1 and 2.

The comments on the differences between PCB toxicity in chicken and raptors (eagles, osprey, kestrels) are not germane because kingfisher is not a close relative of either chicken or raptors. Assuming kingfisher sensitivity to PCBs is similar to that of raptors is as uncertain as assuming it is similar to that of chicken. The FERA assesses risk to kingfisher based on a range of sensitivities to address this uncertainty. Also, in a review of avian studies of dioxin-like toxicity performed by USEPA, chicken was not shown to be unusually sensitive:

> "A conclusion of these analyses is that the domestic chicken is, as is generally recognized, the most sensitive tested species, but it is not aberrantly sensitive. Given the wide range of sensitivities within birds and within mammals to dioxin-like chemicals, test data for chickens should be used." (USEPA 2003).

The review also compared TRVs derived through the species sensitivity distribution (SSD) approach for laboratory versus field studies. The egg TEQ TRVs are lower (showing greater toxicity) based on field studies compared to TRVs based on laboratory studies, even when chicken are included in the laboratory SSD (USEPA 2003). This indicates that the results of chicken studies are not necessarily overprotective for wild birds, and may even be underprotective in some situations.

The particular values of the egg TEQ TRVs used in the FERA are based on enzyme induction, but the TRVs were chosen because they represent a middle range between the values reported in multiple field studies that resulted in reproductive impacts, which are ecologically relevant endpoints.

Comment 275: The FERA assumes 100 % site utilization, but, "at most, approximately 30% of diet could be taken from the upper most reach."

Response: The FERA assumed 100 % site utilization as a starting point, but also assessed the proportion of diet a receptor could obtain from a given reach that would result in exposures equal to the TRVs (Sections 5.3 and D.5). The percent allowable consumption is somewhat overestimated because the receptors are unrealistically assumed to have no PCB exposure outside of the reach under consideration.

Comment 276: The upper most mile of Stout's Creek is currently being developed – North Park development will convert to "a busy commercial/residential district", which "will decrease the usage of this upper portion of the stream by ecological receptors"

Response: Residential and commercial development is not a generally accepted remedial technique for addressing contaminant releases. Development is not a reliable barrier to wildlife use of the remaining natural resources in a developed area. For example, the favored habitats of American mink include lakes, streams, rivers, wooded marshlands and swamps, but mink "also live near urban areas if there is sufficient cover and prey" (ISSG 2006). As documented by Mech (2003), even areas with minimal appropriate cover may be included within the foraging range of mink or otter. Over a 4-year period in a highly urbanized area between the twin cities of St. Paul and Minneapolis, Mech (2003) reported 3 road-killed mink, the tracks of a fourth mink, and river otter signs ("extensive tracks, slides, and feeding holes through thin ice"). Mech (2003) describes the area as follows:

> "It has long been a heavily populated residential, industrial, and business area interlaced with paved streets, highways, and parking lots, and a golf course. The

only nearby natural vegetation is an embankment up to 15 m wide along each side of a railroad track. The only water is a pond of 1.1 ha [2.7 acres] (Walsh Lake) surrounded by a golf course and residential yards. A storm sewer feeds the pond. The nearest natural mink habitat is 3.3-5.7 km [2-3.5 miles] away, with houses, yards, businesses, and six to eight lanes of interstate highway intervening. The nearest extensive waterways where otters might be expected are 3.5-6.0 km [2.2-3.7 miles] away, also separated from the area by the same type of surroundings. ... There was neither natural vegetation nor waterway between the pond and the dead mink. Wherever the mink and otter came from, they had to have passed through yards, lawns, streets, highways, and parking lots, ditches, or possibly sewers."

In this case, the extensive commercial and residential development, and the lack of natural cover, did not deter mink or otter from regularly traveling to and utilizing a pond that is too small to fully support either species.

"[T]he pond probably constituted only a small part of one mink's home range, despite the fact that there was no vegetation or waterway connecting it with any other natural mink habitat." (Mech 2003).

The main difference between the urbanization described by Mech (2003) and the proposed development around the upper portion of Stout's Creek is that a connecting waterway will remain in place. Receptors will be able to easily access the upper portion of Stout's Creek by moving upstream along the creek and will not have to cross miles of commercial and residential development.

Comment 277: Weighted mean PCB by abundance, not arithmetic mean (latter overestimates contribution of white suckers). Station 1 mink diet 3609 μg PCB/kg , ww, arithmetic mean to 2300, weighted mean. Station 2 mink diet 1629 μg PCB/kg , ww, arithmetic mean to 1111, weighted mean

Response: The mink and kingfisher exposure estimates in the FERA are based on a mix of fish prey to provide more realistic values compared to the conventional approach of modeling exposure based on a single, often most contaminated, fish species. However, the precise selection of prey species by mink or kingfisher is not known. Predators are often opportunistic, feeding predominantly on the most available prey, but this does not mean that predators consume prey in the exactly same proportions as their numbers in the environment. Several other factors also influence prey selection, for example, prey size, micro-habitat use by prey, capture effort, and individual preference. There is no guarantee that prey selection will closely track species composition.

Another issue is that the relative abundance of species varies both spatially and temporally. For example, in Richland Creek, the coefficient of variation (CV) for numbers of hog suckers (*Hypentelium nigricans*) collected by electroshocking four segments of a continuous reach is relatively high (0.85) (calculated from Gerking 1953).

In addition to spatial variability, seasonal and annual variability in abundance are also expected.

As shown by the revised calculation in the comment, the overall effect of the suggested change in dietary composition is relatively small. The revised exposure estimates are approximately two-thirds as high as the estimated in the FERA.

Comment 278: Appendix D, Table D-1, 65.33 pg/g LS TEQ at Maple Grove should be 13.9.

Response: The data entry errors in this table have been corrected, the TEQ for this sample recalculated, and the corresponding risk estimates have been revised.

Comment 279: *Weighted average for fish TEQ. Crayfish TEQ should not equal fish TEQ*

Response: Extrapolation of crayfish TEQ from single-sample fish data is highly uncertain. The ratios of PCB concentrations in fish to that in crayfish are based on mean values, and are not appropriately applied to single samples.

Comment 280: Beanblossom Creek is more attractive to potential receptors than Stout's Creek

Response: The comment is based on the seemingly common sense, but mistaken, assumption that differences in the use of different habitats by animals are directly related to differences in habitat quality. This is not necessarily the case, particularly in territorial species. As discussed by Van Horne (1983), in many cases greater densities of animals are found in suboptimal habitat because they have been excluded from the highest quality habitat by dominant individuals. See Garshelis (2000) for other causes of this counterintuitive pattern of habitat use.

Comment 281: While there may still be some hazard quotients estimated to be greater than 1 for the most upstream sections of the creek, because of the small size of these areas and pending high density development, few receptors, if any would actually be able to forage in these more upstream areas. ... The TRVs and receptors modeled were chosen to represent sensitive receptors and thus be protective of other less sensitive receptors. Therefore, after revising the hazard quotients per the above comments, EPA should be comfortable that populations of less sensitive receptors are not at risk."

Response: The opening and closing sentences of this comment are contradictory. If the risk to the selected receptors is disregarded because of the size of the affected area is claimed to be too small, or because of the presumed deterrent effect of development, then there is no basis for concluding that less sensitive receptors are not at risk. The reason for selecting kingfisher and mink as the receptors in the FERA was that actions protecting piscivores from the adverse effects of PCBs are expected to be protective as well for aquatic organisms (fish, amphibians, aquatic invertebrates). However, the home range of these aquatic organisms is much smaller than for either mink or kingfisher, and the presumed unfavorable effect of development, even if it did deter mink or kingfisher use (which is not necessarily the case), would not deter or prevent aquatic organisms from utilizing the same reach.

Comment 282: A number of commenters stated that they would like to see the implementation of EPA's preferred remedy (Alternative 5).

Response: EPA agrees that Alternative 5 is the best alternative to address the continuing release of PCBs into Stout's Creek from the Bennett's Dump site.

Comment 283: A few commenters were concerned that their wells and water supply would be affected by the site remedy and PCBs.

Response: Lowering the water in the surrounding quarries at Bennett's Dump will not affect nearby drinking water wells or the City of Bloomington water supply. The groundwater elevation will only affect the groundwater flow locally at the site. The individuals using groundwater for drinking water will not be affected since the wells are within a different groundwater basin and the lowering of the groundwater elevation will only be localized. EPA has sampled nearby drinking water wells and those wells did not contain any PCBs. Additional drinking water sampling will occur in the near future. The City of Bloomington water supply will not be affected by the Bennett's Dump remedy since the source of the water is Lake Monroe.

Comment 284: A few commenters were concerned that the public meeting was held on Valentines Day which made attendance limited.

Response: The commenter is correct that the meeting was scheduled for Valentines Day. EPA apologizes for scheduling the meeting that day but the auditorium in the Monroe County Public Library was difficult to schedule. EPA will try not to schedule any other public meetings on holidays or special occasions.

Comment 285: One commenter stated that additional health studies should be done on the citizens of Bloomington and a health clinic should be built to address the problems in the county.

Response: The Agency for Toxic Substances and Disease Registry (ATSDR), which is part of the Centers for Disease Control, did complete a health study on the citizens in the 1990's and they continue to study the workers associated with the former Westinghouse capacitor plant. A recent update was presented and is available on the ATSDR web site. You may contact ATSDR about additional studies but EPA does not do health studies. In addition, EPA's mission does not include building a health clinic in Bloomington to address the health affects of PCBs. EPA would recommend that the commenter contact the Monroe County Health Department if they feel they have been affected by PCBs.

REFERENCES – Ecological Risk Assessment Responses

Aulerich, R. and R. Ringer. 1977. Current status of PCB toxicity to mink, and effect on their reproduction. Arch Environ Contam Toxicol 6: 279-292.

Bowerman, W., J. Giesy, D. Best, and V. Kramer. 1995. A review of factors affecting productivity of bald eagles in the Great Lakes region: Implications for recovery. Environ Health Perspect 103: 51-59.

Britton, W. and T. Huston. 1973. Influence of polychlorinated biphenyls in the laying hen. *Poultry Sci 52: 1620-1624.*

Brunström, B., B. Lund, A. Bergman, L. Asplund, I. Athanassiadis, M. Athanasiadou, S. Jensen, and J. Örberg. 2001. Reproductive toxicity in mink (*Mustela vison*) chronically exposed to environmentally relevant polychlorinated biphenyl concentrations. Environ Toxicol Chem 20: 2318-2327.

Burkhard, L., P. Cook, and M. Lukasewycz. 2004. Biota-sediment accumulation factors for polychlorinated biphenyls, dibenzo-p-dioxins, and dibenzofurans in southern Lake Michigan lake trout (*Salvelinus namaycush*). Environ Sci Technol 38: 5297-5305.

Bursian, S., C. Sharma, R. Aulerich, B. Yamini, R. Mitchell, C. Orazio, D. Moore, S. Siversky, and D. Tillitt. 2006. Dietary exposure of mink (*Mustela vison*) to fish from the Housatonic River, Berkshire County, Massachusetts, USA: effects on reproduction, kit growth, and survival. Environ Toxicol Chem 25: 1533-1540.

Calabrese, E. 2005. Paradigm lost, paradigm found: the re-emergence of hormesis as a fundamental dose response model in the toxicological sciences. Environ Pollut 138: 379-412.

Cecil, H., J. Bitman, R. Lillie, G. Fries, and J. Verrett. 1974. Embryotoxic and teratogenic effects in unhatched fertile eggs from hens fed polychlorinated biphenyls (PCBs). Bull Environ Contam Toxicol 11: 489-495.

Connor, K., M. Eversen, S. Su, and B. Finley. 2005. Quantitation of polychlorinated biphenyls in fish for human cancer risk assessment: a comparative case study. Environ Toxicol Chem 24: 17-24.

Custer, C. and L. Read. 2006. Polychlorinated biphenyl congener patterns in tree swallows (*Tachycineta bicolor*) nesting along the Housatonic River watershed, western Massachusetts, USA, using a novel statistical approach. Environ Pollut 142: 235-245.

Custer, C., T. Custer, P. Dummer, and K. Munney. 2003. Exposure and effects of chemical contaminants on tree swallows nesting along the Housatonic River, Berkshire County, Massachusetts, USA, 1998-2000. Environ Toxicol Chem 22: 1605-1621.

Garshelis, D. 2000. Delusions in habitat evaluation: measuring use, selection, and importance. *In*: Boitani, L. and T. Fuller (eds.). 2000. Research Techniques in Animal Ecology, Controversies and Consequences. Columbia Univ. Press, New York. pp. 111-164.

Gerking, S. 1953. Evidence for the concepts of home range and territory in stream fishes. Ecol 34: 347-365.

Giesy, J., W. Bowerman, M. Mora, D. Verbrugge, R. Othoudt, J. Newsted, C. Summer, R. Aulerich, S. Bursian, J. Ludwig, G. Dawson, T. Kubiak, D. Best, and D. Tillitt. 1995. Contaminants in fishes from Great Lakes-influenced section above dams of three Michigan rivers. III: Implications for health of bald eagles. Arch Environ Contam Toxicol 29: 309-321.

Henny, C., J. Kaiser, R. Grove, V. Bentley, and J. Elliott. 2003. Biomagnification factors (fish to osprey eggs from Willamette River, Oregon, U.S.A.) for PCDDs, PCDFs, PCBs, and OC pesticides. Environ Monit Assess 84: 275-315.

Hoffman, D., C. Rice and T. Kubiak. 1996. PCBs and dioxins in birds. *In* Environmental Contaminants in Wildlife, Interpreting Tissue Concentrations. (W. Beyer, G. Heinz and A. Redmon-Norwood, eds.). Lewis, Boca Raton. pp. 165-207.

Isnard, P., P. Flammarion, G. Roman, M. Babut, P. Bastien, S. Bintein, L. Esserméant, J. Férard, S. Gallotti-Schmitt, E. Saouter, M. Saroli, H. Thiébaud, R. Tomassone, and E. Vindimian. 2001. Statistical analysis of regulatory ecotoxicity tests. Chemosphere 45: 659-669.

ISSG. 2006. *Mustela vison* (mammal), Ecology. Global Invasive Species Database, Invasive Species Specialist Group (ISSG), The World Conservation Union (IUCN). www.issg.org

Kihiström, J., M. Olsson, S. Jensen, Å. Johansson, J. Ahlbom, and A. Bergman. 1992. Effect of PCB and different fractions of PCB on the reproduction of the mink (*Mustela vison*). Ambio 21: 563-601.

Leonards, P., T. de Vries, W. Minnaard, S. Stuijfzand, P. de Voogt, W. Cofino, N. van Straalen and B. van Hattum. 1995. Assessment of experimental data on PCB-induced reproduction inhibition in mink, based on an isomer- and congener-specific approach using 2,3,7,8-tetrachlorodibenzo-*p*-dioxin toxic equivalency. Environ Toxicol Chem 14: 639-652.

Lillie, R., H. Cecil, J. Bitman, and G. Fries. 1974. Differences in response of caged white leghorn layers to various polychlorinated biphenyls (PCBs) in the diet. Poultry Sci 53: 726-732.

Lillie, R., H. Cecil, J. Bitman, G. Fries, and J. Verrett. 1975. Toxicity of certain polychlorinated and polybrominated biphenyls on reproductive efficiency of caged chickens. Poultry Sci 54: 1550-1555.

Linzey, A. 1987. Effects of chronic polychlorinated biphenyls exposure on reproductive success of white-footed mice (*Peromyscus leucopus*). Arch Environ Contam Toxicol 16: 455-460.

Linzey, A. 1988. Effects of chronic polychlorinated biphenyls exposure on growth and reproduction of second generation white-footed mice (*Peromyscus leucopus*). Arch Environ Contam Toxicol 17: 39-45.

Marvin, C., E. Howell, T. Kolic, and E. Reiner. 2002. Polychlorinated dibenzo-*p*-dioxins and dibenzofurans and dioxinlike polychlorinated biphenyls in sediments and mussels at three sites in the lower Great Lakes, North America. Environ Toxicol Chem 21: 1908-1921.

McCoy, G., M. Finlay, A. Rhone, K. James, and G. Cobb. 1995. Chronic polychlorinated biphenyls exposure on three generations of oldfield mice (*Peromyscus polionotus*): effects on reproduction, growth, and body residues. Arch Environ Contam Toxicol 28: 431-435.

Mech, D. 2003. Incidence of mink, *Mustela vison*, and river otter, *Lutra canadensis*, in a highly urbanized area. Can Field Naturalist 117: 115-116. www.npwrc.usga.gov/resource/mammals/minkottr/minkottr/htm

Mineau, P. 2005. A review and analysis of study endpoints relevant to the assessment of "long term" pesticide toxicity in avian and mammalian wildlife. Ecotoxicol 14: 775-799.

Murata, M., S. Masunaga, and J. Nakanishi. 2003. Population-level ecological risk assessment of planar polychlorinated aromatic hydrocarbons in great cormorant (*Phalacrocorax carbo*) around Tokyo Bay, Japan. Environ Toxicol Chem 22: 2508-2518.

Murray, F., F. Smith, K. Nitschke, C. Humiston, R. Kociba, and B. Schwetz. 1979. Three-generation reproduction study of rats given 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in the diet. Toxicol Appl Pharmacol 50: 241-252.

Naito, W., J. Jin, Y. Kang, M. Yamamuro, S. Masunaga, and J. Nakanishi. 2003. Dynamics of PCDDs/DFs and coplanar-PCBs in an aquatic food chain of Tokyo Bay. Chemosphere 53: 347-362.

Niimi, A. 1996. Evaluation of PCBs and PCDD/Fs retention by aquatic organisms. Sci Total Environ 192: 123-150.

Platonow, N. and B. Reinhart. 1973. The effects of polychlorinated biphenyls Aroclor 1254 on chicken egg production fertility and hatchability. Can J Comp Med 37: 341-346.

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J Toxicol Environ Health Part A 54: 343-375.
Sather, P., J. Newman, and M. Ikonomou. 2003. Congener-based Aroclor quantification and speciation techniques: a comparison of the strengths, weaknesses, and proper use of two alterative approaches. Environ Sci Technol 37: 5678-5686.

Scott, M. 1977. Effects of PCBs, DDT and mercury compounds in chickens and Japanese quail. Fed Proceed 36: 1888-1893.

Summer, C., J. Giesy, S. Bursian, J. Render, T. Kubiak, P. Jones, D. Verbrugge, and R. Aulerich. 1996a. Effects induced by feeding organochlorine-contaminated carp from Saginaw Bay, Lake Huron, to laying white leghorn hens. I. Effects on health of adult hens, egg production, and fertility. J Toxicol Environ Health 49: 389-407.

Summer, C., J. Giesy, S. Bursian, J. Render, T. Kubiak, P. Jones, D. Verbrugge, and R. Aulerich. 1996b. Effects induced by feeding organochlorine-contaminated carp from Saginaw Bay, Lake Huron, to laying white leghorn hens. II. Embryotoxic and teratogenic effects. J Toxicol Environ Health 49: 409-438.

Tanaka, Y. and J. Nakanishi. 2001. Model selection and parameterization of the concentration-response functions for population-level effects. Environ Toxicol Chem 20: 1857-1865.

Tillitt, D., G. Ankley, J. Giesy, J. Ludwig, H. Kurita-Matsuba, D. Weseloh, P. Ross, C. Bishop, L. Sileo, K. Stromborg, J. Larson, and T. Kubiak. 1992. Polychlorinated biphenyl residues and egg mortality in double-crested cormorants from the Great Lakes. Environ Toxicol Chem 11: 1281-1288.

USACE/USEPA. 2004. Ecological Risk Assessment for General Electric (GE)/Housatonic River Site Rest of River. Prepared by Weston Solutions, Inc. for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. http://www.epa.gov/region1/ge/thesite/restofriver-reports.html

USEPA. 2003. Analyses of Laboratory and Field Studies of Reproductive Toxicity in Birds Exposed to Dioxin-like Compounds for Use in Ecological Risk Assessment. National Center for Environmental Assessment, Office of Research and Development, Cincinnati. EPA/600/R-03/114F.
http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=56937

Van der Oost, R., A. Opperhuizen, K. Satumalya, H. Heida, and N. Vermeulen. 1996. Biomonitoring aquatic pollution with feral eel (Anguilla anguilla) I. Bioaccumulation: biota-sediment ratios of PCBs, OCPs, PCDDs and PCDFs. Aquatic Toxicol 35: 21-46.

Van Horne, B. 1983. Density as a misleading indicator of habitat quality. J Wildlife Management 47: 893-901.

Wakimoto, T., N. Kannan, M. Ono, R. Tatsukawa, and Y. Masuda. 1988. Isomer-specific determination of polychlorinated dibenzofurans in Japanese and American polychlorinated biphenyls. Chemosphere 17: 743-750.

Wren, C., D. Hunter, J. Leatherland, and P. Stokes. 1987. The effects of polychlorinated biphenyls and methylmercury, singly and in combination on mink. I. uptake and toxic responses. Arch Environ Contam Toxicol 16: 441-447; and II. reproduction and kit development. Arch Environ Contam Toxicol 16: 449-454.

Yamashita, N., K. Kannan, T. Imagawa, A. Miyazaki, and J. Giesy. 2000. Concentrations and profiles of polychlorinated naphthalene congeners in eighteen technical polychlorinated biphenyl preparations. Environ Sci Technol 34: 4236-4241.

Yanik, P., T. O'Donnell, S. Macko, Y. Qian, and M. Kennicut II. 2003. Source apportionment of polychlorinated biphenyls using compound specific isotope analysis. Organic Geochem 34: 239-251.

REFERENCES – Human Health Risk Assessment Responses

Agency for Toxic Substance and Disease Registry (ATSDR). 1998. "Toxicological Profile for Chlorinated Dibenzo-p-Dioxins." Public Health Service. U.S. Department of Health Services. December. On-Line Address: http://www.atsdr.cdc.gov/toxprofiles/tp104-p.pdf

CBS Corporation (CBS). 2005. Comments on BD Human Health Risk Assessment. October 10.

Javitz, H. 1980. "Seafood Consumption Data Analysis." SRI International. Final Report prepared for EPA Office of Water Regulations and Standards.

Rupp, E.M. and Others. 1980. "Some Results of Recent Surveys of Fish and Shellfish Consumption by Age and Region of U.S. Residents." *Health Physics*. Volume 39. Pages 165 through 175.

Tetra Tech EM Inc. (Tetra Tech). 2004. "Field Oversight Summary for May 25 through 28, 2004, Stout's Creek Investigation, Bennett's Dump Site, Monroe County, Indiana."

U.S. Environmental Protection Agency (EPA). 1984. "Ambient Water Quality Criteria for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin." Office of Water Regulations and Standards. EPA 440/5-84-007. February. On-Line Address: http://www.epa.gov/waterscience/library/wqcriteria/dioxincriteria.pdf

EPA. 1989. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)" (RAGS). Interim Final. Office of Emergency and Remedial Response (OERR). Washington, DC. EPA/540/1-89/002. December.

EPA. 1990. "National Oil and Hazardous Substances Pollutant Contingency Plan (NCP)." *Federal Resister.* Volume 55, Number 46. April 9.

EPA. 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." Office of Solid Waste and Emergency Response (OSWER). Publication 9285.7-08I. May.

EPA. 1997. "Exposure Factors Handbook." Volumes 1 through 3. Office of Research and Development (ORD). EPA/600/P-95/002Fa, -Fb, and –Fc. August.

EPA. 2002a. "Estimated per Capita Fish Consumption in the United States." EPA-821-C-02-003. August.

EPA. 2002b. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OERR. OSWER 9285.6-10. December.

EPA. 2003. "Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds, National Academy of Science Review Draft." December. On-Line Address: http://www.epa.gov/ncea/pdf/doxin/nas-review/#part1

EPA. 2004a. "ProUCL Version 3.0 User Guide." Prepared by A. Singh, A.K. Singh, and R.W. Maichle for EPA Technical Support Center, Las Vegas, NV. April.

EPA. 2004b. Technical Memorandum Regarding Review of "Comments by Viacom, Inc. on U.S. EPA's Human Health Evaluation for Fish Consumption at Neal's Landfill." From Dr. Rick Herzberg, Superfund Technical Support Center (STSC). To Patricia Daunt, Administrator, STSC, August 20. Forwarded to Dr. Milt Clark, Health and Science Advisor, Region 5, with cover sheet dated August 23, 2004.

EPA. 2004c. Memorandum Regarding Responses to February 26, 2004 document "Comments of Viacom, Inc. on the U.S. EPA's Human Health Evaluation for Fish Consumption at Neal's Landfill. From Milton Clark, Ph.D., Health and Science Advisor. To Thomas Alcamo, Remedial Project Manager. September 8.

EPA. 2005. "Human Health Risk Assessment GE/Housatonic River Site, Rest of River." February 11.

Viacom , Inc. (Viacom). 2004. Comments of Viacom, Inc. of the U.S. EPA's Human Health Evaluation for Fish Consumption at Neal's Landfill. February 4.

Viacom. 2005. "Groundwater, Surface Water, Flow and Water Level Monitoring, Second Quarter 2004, Bennett's Dump, Monroe County, Indiana." January 25.

West, P.C., and Others. 1989. "Michigan Sport Anglers Fish Consumption Survey, A Report to the Michigan Toxic Substance Control Commission." Natural Resource Sociology Research Lab Technical Report #1. May

ATTACHMENT 1

REVISED SURFACE WATER EXPOSURE POINT CONCENTRATION
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

ATTACHMENT 1

REVISED SURFACE WATER EXPOSURE POINT CONCENTRATION
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

					Data
Raw Statistics		Normal Distribution Test			0.37
Number of Valid Samples	36	Shapiro-Wilk Test Statisitic	0.77741		0.39
Number of Unique Samples	25	Shapiro-Wilk 5% Critical Value	0.935		0.28
Minimum	0.05	Data not normal at 5% significance level			0.19
Maximum	1.15				0.29
Mean	0.264583	95% UCL (Assuming Normal Distribution)			0.39
Median	0.225	Student's-t UCL	0.32124		0.13
Standard Deviation	0.201198				0.39
Variance	0.040481	Gamma Distribution Test			0.23
Coefficient of Variation	0.760432	A-D Test Statistic	0.333098		0.62
Skewness	2.603546	A-D 5% Critical Value	0.757622		0.4
		K-S Test Statistic	0.088964		0.43
Gamma Statistics		K-S 5% Critical Value	0.148442		0.15
k hat	2.34182	Data follow gamma distribution			0.255
k star (bias corrected)	2.165187	at 5% significance level			0.29
Theta hat	0.112982				0.44
Theta star	0.122199	95% UCLs (Assuming Gamma Distribution)			1.15
nu hat	168.611	Approximate Gamma UCL	0.322179		0.12
nu star	155.8934	Adjusted Gamma UCL	0.325087		0.12
Approx.Chi Square Value (.05)	128.0246				0.12
Adjusted Level of Significance	0.0428	Lognormal Distribution Test			0.18
Adjusted Chi Square Value	126.8792	Shapiro-Wilk Test Statisitic	0.967131		0.22
		Shapiro-Wilk 5% Critical Value	0.935		0.11
Log-transformed Statistics		Data are lognormal at 5% significance level			0.35
Minimum of log data	-2.99573				0.17
Maximum of log data	0.139762	95% UCLs (Assuming Lognormal Distribution)			0.35
Mean of log data	-1.55805	95% H-UCL	0.343409		0.25
Standard Deviation of log data	0.698088	95% Chebyshev (MVUE) UCL	0.413213		0.05
Variance of log data	0.487327	97.5% Chebyshev (MVUE) UCL	0.476727		0.13
		99% Chebyshev (MVUE) UCL	0.601487		0.18
					0.21
		95% Non-parametric UCLs			0.235
		CLT UCL	0.31974		0.085
		Adj-CLT UCL (Adjusted for skewness)	0.335288		0.05
		Mod-t UCL (Adjusted for skewness)	0.323665		0.15
		Jackknife UCL	0.32124		0.05
		Standard Bootstrap UCL	0.317298		
		Bootstrap-t UCL	0.346663		
RECOMMENDATION		Hall's Bootstrap UCL	0.458477		
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	0.323472		
		BCA Bootstrap UCL	0.339167		
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	0.41075		
		97.5% Chebyshev (Mean, Sd) UCL	0.473997		
		99% Chebyshev (Mean, Sd) UCL	0.598232		

ATTACHMENT 2

REVISED EXPOSURE, RISK, AND HAZARD CALCULATIONS
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

TABLE 1

REVISED FISH TISSUE EXPOSURE POINT CONCENTRATIONS[a]
HUMAN HEALTH RISK ASSESSMENT
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

Fish Species	Sample Type	Location BD-1[b]		Location BD-2[b]		Location BD-3[b]	
		Total PCB EPC (µg/kg)	WHO-TEQ EPC (ng/kg)	Total PCB EPC (µg/kg)	WHO-TEQ EPC (ng/kg)	Total PCB EPC (µg/kg)	WHO-TEQ EPC (ng/kg)
Green Sunfish	Fillet	503	NA	678	NA	240	NA
Green Sunfish (Longear Sunfish at Location BD-3)	Whole body (converted to fillet)	832	6.74	402	3.42	176	3.48
White Sucker	Whole body (converted to fillet)	NA	NA	2,331	20.35	481	6.32
Weighted Average[c]	–	NA	NA	455	3.49	201	3.57

Notes:

µg/kg = Microgram per kilogram
ng/kg = Nanogram per kilogram
EPC = Exposure point concentration
NA = Not applicable
PCB = Polychlorinated biphenyl
TEQ = Toxicity equivalent
WHO = *World Health Organization*

[a] See Appendix B and Section 3.3.1.
[b] Sampling locations BD-1, BD-2, and BD-3 are about 1, 3, and 5 miles downstream of the Bennett's Dump site, respectively (see Figure 5).
[c] Weighted average concentrations are discussed in EPA's response regarding Fish Consumption – Development of EPCs.

TABLE 2

REVISED FISH TISSUE RISK AND HAZARD SUMMARY
HUMAN HEALTH RISK ASSESSMENT
BENNETT'S DUMP
BLOOMINGTON, MONROE, COUNTY, INDIANA

	Risk[a]		Hazard[a]	
Location[b]	**PCB**	**TEQ[c]**	**PCB**	**TEQ[c]**
BD-1 (Hunter Road)				
Green Sunfish (fillet)	3.1E-06	NA	1.8E-01	NA
Green Sunfish (whole -> fillet)	5.1E-06	3.1E-06 (2.1E-05)	3.0E-01	4.80E-02
BD-2 (Acuff Road)				
Green Sunfish (fillet)	1.2E-05	NA	7.3E-01	NA
Green Sunfish (whole -> fillet)	7.4E-06	4.7E-06 (3.1E-05)	4.3E-01	7.3E-02
White Sucker (whole -> fillet)	4.3E-05	2.8E-05 (1.9E-04)	2.5E+00	4.4E-01
Combination	8.3E-06	4.8E-06 (3.2E-05)	4.8E-01	7.5E-02
BD-3 (W. Maple Grove Road)				
Green Sunfish (fillet)	4.4E-06	NA	2.6E-01	NA
Longear Sunfish (whole -> fillet)	3.2E-06	4.8E-06 (3.2E-05)	1.9E-01	7.5E-02
White Sucker (whole -> fillet)	8.8E-06	8.7E-06 (5.8E-05)	5.2E-01	1.4E-01
Combination	3.7E-06	4.9E-06 (3.3E-05)	2.2E-01	7.2E-02

Notes:

Avg = Average
EPA = U.S. Environmental Protection Agency
mg/kg-day = Milligrams per kilogram per day
NA = Not applicable
PCB = Polychlorinated biphenyl
RME = Reasonable maximum exposure
TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent

a Results calculated as described in the HHRA using revised exposure point concentrations (see Table 1).
b See Figure 5 for locations BD-1 through BD-3.
c Values are presented in the form a(b), where a = risk based on current EPA slope factor of 1.5E+05 $(mg/kg\text{-}day)^{-1}$, and b = risk based on EPA's alternative slope factor of 1E+06 $(mg/kg\text{-}day)^{-1}$. See Section 4.2 of the HHRA.

TABLE 3

REVISED TOTAL RISK ESTIMATES[a]
HUMAN HEALTH RISK ASSESSMENT
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

Exposure Pathway	Location[b]		
	BD-1 (Hunter Road)	**BD-2 (Acuff Road)**	**BD-3 (W. Maple Grove Road)**
Fish Ingestion[c]	5.1E-06[d]	8.3E-06	3.7E-06
Surface Water - Incidental Ingestion[e]	5.3E-09	5.3E-09	5.3E-09
Surface Water - Dermal Contact[f]	3.7E-06	3.7E-06	3.7E-06
Sediment - Incidental Ingestion	4.3E-08	4.3E-08	4.3E-08
Sediment - Dermal Contact	3.9E-08	3.9E-08	3.9E-08
TOTALS[g]	9E-06 (57)	1E-05 (69)	7E-06 (49)

Notes:

RME = Reasonable maximum exposure

a Calculated as described in the HHRA with the revisions described below for individual pathways. All risk values presented are for adult receptors.
b See Figure 5 for locations BD-1 through BD-3.
c Risks presented represent PCB risks based on weighted average exposure point concentrations (EPC) (see Table 1), unless otherwise noted.
d Risks presented represent PCB risks based on green sunfish (whole=>fillet) consumption.
e Calculated as described in the HHRA with the following revisions: (1) ingestion rate - surface water for adults was revised from 3.8E-02 to 7.5E-03 L/day and (2) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1).
f Calculated as described in the HHRA with the following revisions: (1) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1) and (2) the exposure time was revised from 2 hours/day to 1 hour/day.
g Parenthetical values represent the percent of the total risk represented by the fish ingestion risk.

TABLE 3

REVISED TOTAL RISK ESTIMATES[a]
HUMAN HEALTH RISK ASSESSMENT
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

Exposure Pathway	Location[b]		
	BD-1 (Hunter Road)	BD-2 (Acuff Road)	BD-3 (W. Maple Grove Road)
Fish Ingestion[c]	5.1E-06[d]	8.3E-06	3.7E-06
Surface Water - Incidental Ingestion[e]	5.3E-09	5.3E-09	5.3E-09
Surface Water - Dermal Contact[f]	3.7E-06	3.7E-06	3.7E-06
Sediment - Incidental Ingestion	4.3E-08	4.3E-08	4.3E-08
Sediment - Dermal Contact	3.9E-08	3.9E-08	3.9E-08
TOTALS[g]	9E-06 (57)	1E-05 (69)	7E-06 (49)

Notes:

RME = Reasonable maximum exposure

[a] Calculated as described in the HHRA with the revisions described below for individual pathways. All risk values presented are for adult receptors.

[b] See Figure 5 for locations BD-1 through BD-3.

[c] Risks presented represent PCB risks based on weighted average exposure point concentrations (EPC) (see Table 1), unless otherwise noted.

[d] Risks presented represent PCB risks based on green sunfish (whole=>fillet) consumption.

[e] Calculated as described in the HHRA with the following revisions: (1) ingestion rate - surface water for adults was revised from 3.8E-02 to 7.5E-03 L/day and (2) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1).

[f] Calculated as described in the HHRA with the following revisions: (1) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1) and (2) the exposure time was revised from 2 hours/day to 1 hour/day.

[g] Parenthetical values represent the percent of the total risk represented by the fish ingestion risk.

TABLE 4

TOTAL HAZARD ESTIMATES[a]
HUMAN HEALTH RISK ASSESSMENT
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA

Exposure Pathway	Location[b]		
	BD-1 (Hunter Road)	BD-2 (Acuff Road)	BD-3 (W. Maple Grove Road)
Fish Ingestion[c]	3.0E-01[d]	4.8E-01	2.2E-01
Surface Water - Incidental Ingestion[e]	3.3E-04	3.3E-04	3.3E-04
Surface Water - Dermal Contact[f]	2.1E-01	2.1E-01	2.1E-01
Sediment - Incidental Ingestion	2.5E-03	2.5E-03	2.5E-03
Sediment - Dermal Contact	2.3E-03	2.3E-03	2.3E-03
TOTALS[g]	5.2E-01 (58)	7.0E-01 (69)	4.4E-01 (51)

Notes:

RME = Reasonable maximum exposure

a Calculated as described in the HHRA with the revisions described below for individual pathways All hazard values presented are for adult receptors.

b See Figure 5 for locations BD-1 through BD-3.

c Hazards presented represent PCB hazards based on weighted average exposure point concentrations (EPC) (see Table 1), unless otherwise noted.

d Hazards presented represent PCB hazards based on green sunfish (whole=>fillet) consumption.

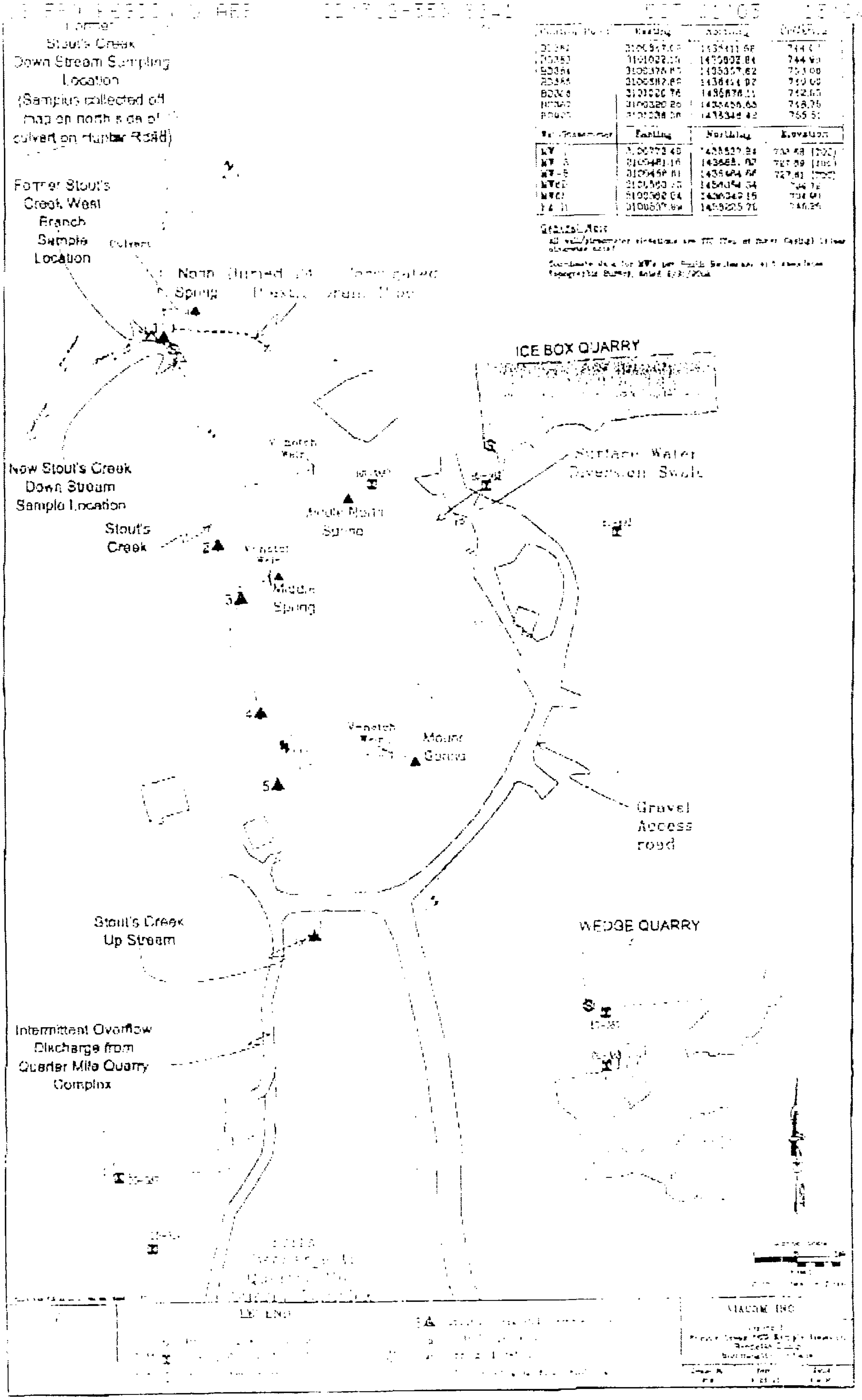
e Calculated as described in the HHRA with the following revisions: (1) ingestion rate - surface water for adults was revised from 3.8E-02 to 7.5E-03 L/day and (2) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1).

f Calculated as described in the HHRa with the following revisions: (1) the surface water EPC was revised from 1.2 to 0.32 μg/L (see Attachment 1) and (2) the exposure time was revised from 2 hours/day to 1 hour/day.

g Parenthetical values represent the percent of the total hazard represented by the fish ingestion hazard.

ATTACHMENT 3

MASS BALANCE CALCULATIONS IN STOUT'S CREEK
BENNETT'S DUMP
BLOOMINGTON, MONROE COUNTY, INDIANA



[illegible]	Easting	Northing	Elevation
[illegible]	[illegible]	[illegible]	744.[illegible]
[illegible]	3101022.[illegible]	1435002.84	744.[illegible]
[illegible]	3100376.87	1435357.62	753.00
[illegible]	3100582.89	1436454.02	749.00
[illegible]	3101020.76	1436878.11	742.65
[illegible]	3100320.26	1435456.65	748.75
[illegible]	[illegible]	1435348.42	765.51

[illegible]	Easting	Northing	Elevation
MW-[illegible]	[illegible]	[illegible]	[illegible]
MW-3	3100481.16	[illegible]	727.59
MW-5	3100458.81	1435624.66	727.81
MW[illegible]	[illegible]	1436054.34	[illegible]
MW[illegible]	3100382.04	[illegible]	734.01
[illegible]	3100537.64	1435205.76	746.24

General Note

STOUT'S CREEK 9-23-03
1030 – 1130 hrs

FLOW ACROSS RIFFLES ABOUT 2.0 fps

GRAVEL RIFFLE 4'w x 0.2'd

POOL BY STAFF GAUGE 7'w x 1.5'd

GRAVEL RIFFLE MOSTLY AND SMALL POOLS 3-6'w 0.4'd

SCOUR POOL 2'd AT CHANNEL CONFLUENCE, UPSTR. AND DOWNST. RIFFLES

ALTERNATING RIFFLES AND POOLS EVERY 10-15' 4' TO 7'W 0.5-1'd

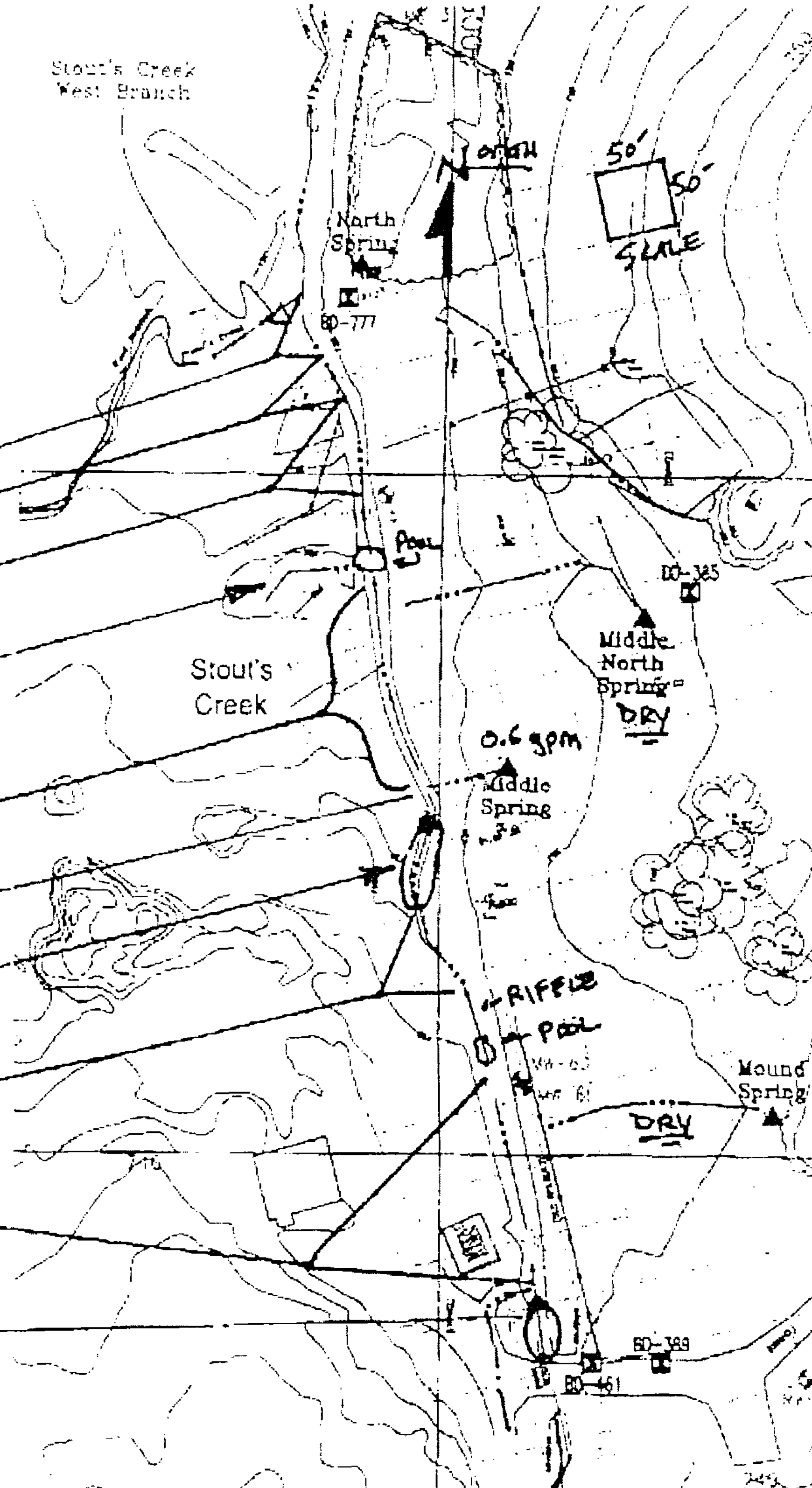
MIDDLE SP FLOW NOT VISIBLE INTO CREEK

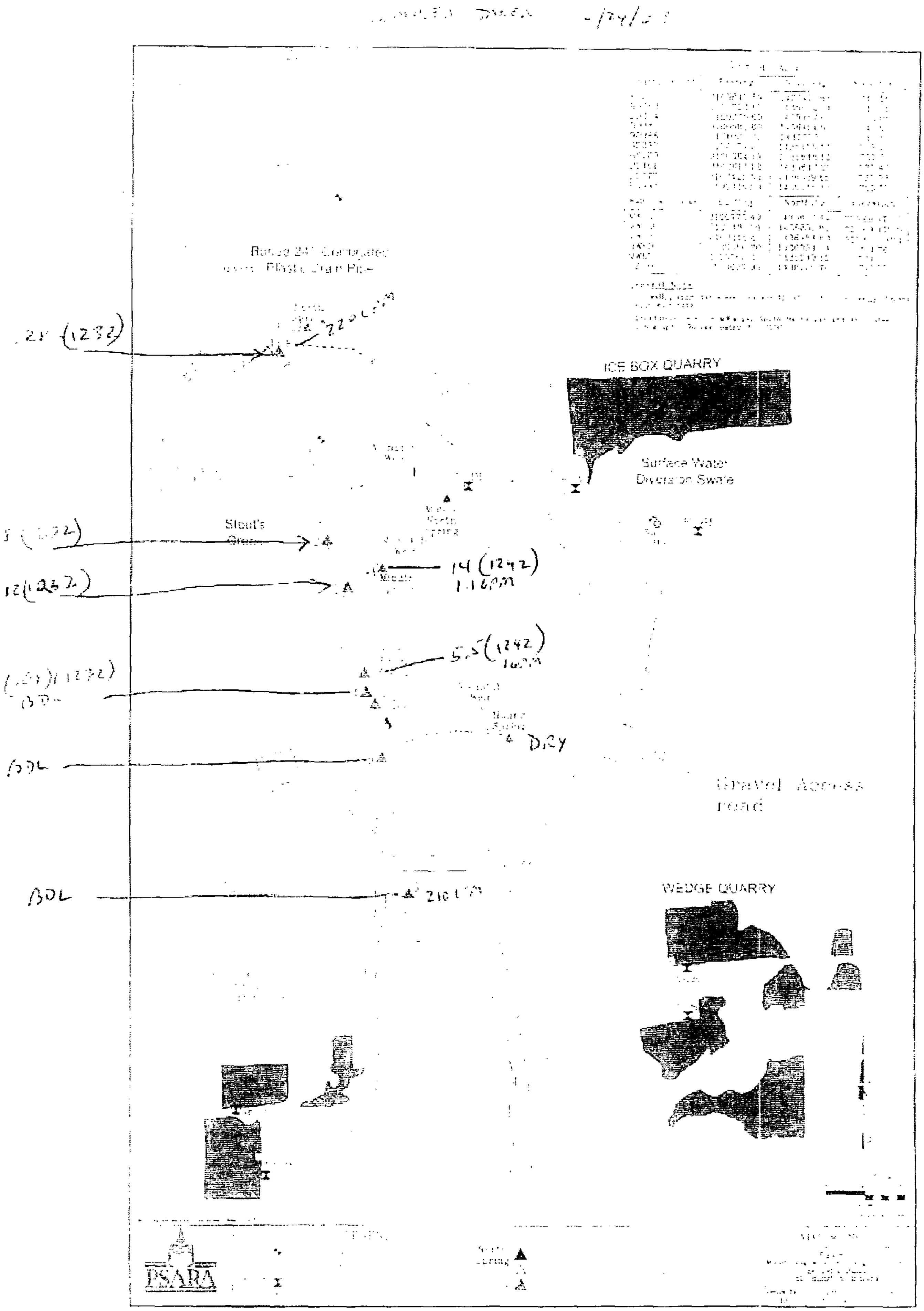
BEAVER DAM 2'H WITH 50' POOL 2'd AND 12'W BEHIND IT

BACKWATER EFFECT FROM DAM 0.5' TO 1'd, 8-10' W SLOW FLOW

ROCKY RIFFLES (LS DEBRIS) MOSTLY, WITH SMALL POOLS

BEAVER DAM WITH 2'd POOL RIGHT UP TO ROAD CROSSING




ICE BOX QUARRY
Surface Water
Diversion Swale
12(1232)
14 (1242)
5.5 (1242)
DRY
BDL
Gravel Access
road
WEDGE QUARRY
BDL
PSARA

Mass Loading of PCBs in Stout's Creek 10/24/03

Desc	Sample Pt Number	PCB (ug/L)	Aroclor	Flow (gpm)	Mass Rate (ug/min)
SC Downstream	1	0.28	1232	220	246
	2	0.18	1232	218	157
Middle Spring		14	1242	1.1	62
	3	0.12	1232	215	103
Rusty Spring Down		5.5	1242	1	22
	4	0.08	1232	213	68
	5	<.1	NA	212	NA
SC Upstream	6	<.1	NA	210	NA